May 1957

EDITORIAL

OUR 17-inch TV set, a description of which commences with this issue, is something of a landmark for us.

It is our answer to the many readers and experimenters who have been waiting so long for a lead on how to go about building their own at the lowest cost and with a reasonable chance of success.

We have been amazed at the amount of interest and intelligent work which such people have brought to bear on home-made TV. It is obvious that, if TV has intrigued radiomen who build and operate it commercially, it has done the same to those who like to work with their hands for amusement and profit.

We could do no less than play our part in helping them over some of their difficulties, and suggesting a way which they could follow.

We feel sure, too, that our design will be of great value to those who are setting out on a new career in TV —to servicemen, students and all learners in the new field.

We are grateful to the many manufacturers and members of the trade who are supporting our efforts by releasing vital components, which will help immeasurably in getting results. Naturally selling components is their business, but there is more to it than that.

I am sure they all feel, as we feel, that we are carrying out an obligation to our supporters in meeting the challenge of a new art.

We do not pretend that our first effort is the ultimate, nor that we will not be able to build upon it as time goes by.

Our aim was to crystallise and simplify what we think is the best in standard TV techniques, adapting them to our own purposes of simplicity, and, we hope, success.

A little later on, we expect to follow the same process with a much more modest 5-inch TV project, designed primarily as a training ground for more elaborate receivers. But these things cannot be hurried, and we will not publish anything until we are satisfied that we have a design tested and found good.

The results already achieved by those working almost in the dark have taught us one lesson—we will never underestimate the determination and ingenuity of the budding Australian engineer.

John Moyle

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RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION, HOBBIES AND POPULAR SCIENCE

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OUR COVER PICTURE

A new electronic method of printing is the Electrofax, the principle of which is described on page 9. An operator is seen applying the special brush which brings up the image.

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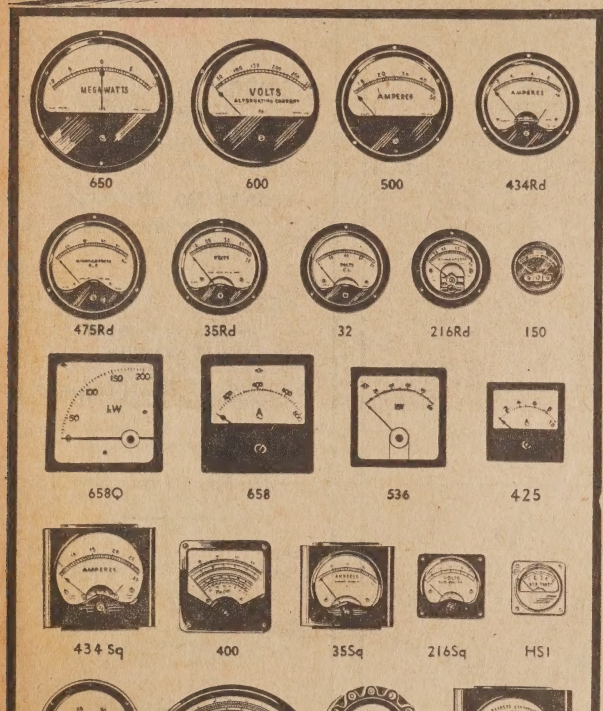

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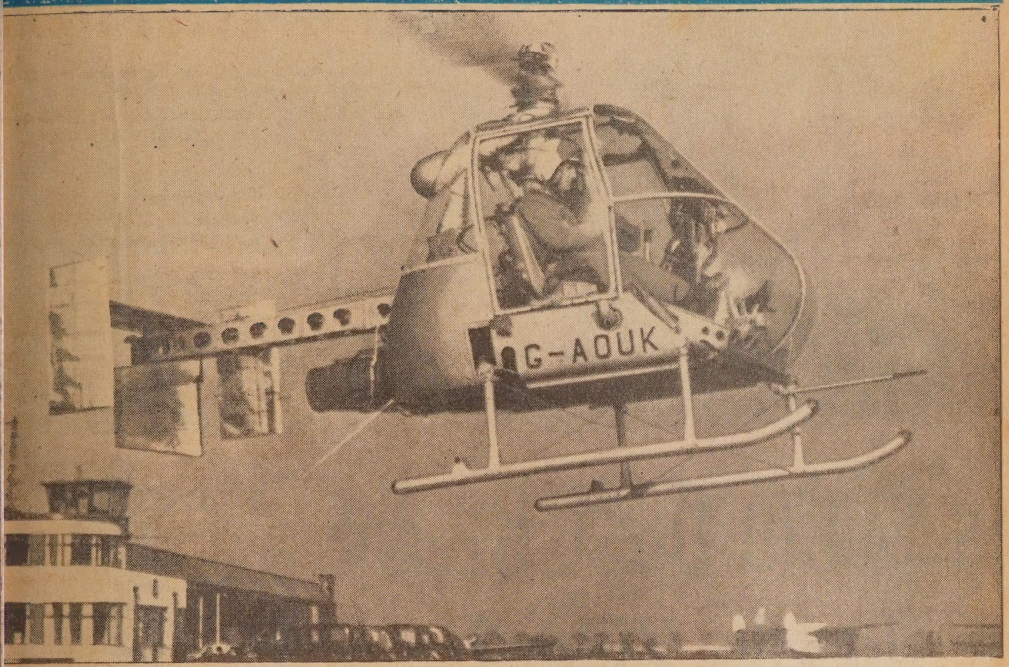
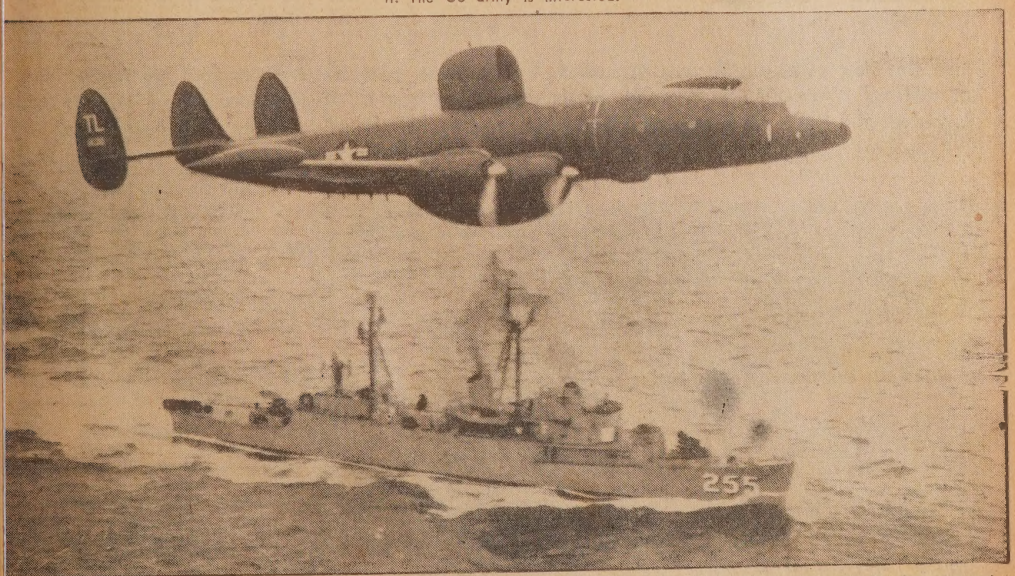
CONTRASTS IN DEFENCE BY AIR



The Fairey ultra-light helicopter—weighing only 1800lbs all up, rugged and simple to fly — has a maximum top speed of 105pmh and a cruising speed of 85mph. It can be transported by 3 ton truck from which it can take off and land. Four men can move it. The US army is interested.



A US Navy radar-equipped plane of the airborne early warning squadron and a radar picket ship cross paths as they proceed to assigned stations in "Barrier Atlantic"—a seaward extension into the N. Atlantic of three land-based early warning stations. Patrol continues day and night regardless of weather. Plane is version of the Super Constellation.

The dust cloud from a Pacific atomic explosion begins its long journey into space.

Is Bomb Dust Really A Deadly Killer?

This is the kind of radioactive cloud which, penetrating deeply into the troposphere, carries with it the seeds of destruction and death. Portions of this cloud may not fall back to the earth for years to come.

Since the first atom-bomb was exploded, the danger from the end products to human life has worried scientists and general public alike. Can these bombs damage and kill living things long after the blast itself has died away? And if so, how deadly are they? This authoritative article gives some new answers to these questions.

THE wraps are off one of the greatest of scientific studies under way today —world-wide in scope, of utmost concern to everyone on earth. Known only as project Sunshine, and only recently made available by the US Atomic Energy Commission, its aim is to gauge the hazard to health of the radioactive strontium 90 that nuclear bomb tests are depositing in our soil, our food, and finally in us.

For recent evidence puts the finger on strontium 90, a potential cause of bone cancer and of leukemia or blood cancer as the principal hazard of the radioactive fallout that A-bombs and H-bombs are scattering all over the earth. That conclusion marks a radical reversal of thinking in the past.

EFFECT ON GENES

Until lately, scientists most concerned over the fallout have been geneticists. Their widely publicised fear has been that the body-penetrating gamma rays of fall out would cause harmful changes in the individual's genes, the seeds of heredity—and lead to an abnormally high number of cripples and other defectives in generations to come.

But a celebrated study completed last year by 150 leading scientists for the National Academy of Sciences disposed of that bugaboo for the present at least. It found our exposure to this kind of fallout radioactivity to be insignificant compared with the ever-present background of natural radioactivity from sources like cosmic rays and radium and thorium in the earth.

Strontium 90, in contrast, has nothing to do with genetics or heredity. Instead of the penetrating gamma rays that come from some ingredients of fallout, it emits only short-range beta rays. So it's harmless while it lies in the ground and until plants absorb it, cattle eat it, and it enters your food. Then, built into your bones along with the calcium that it chemically resembles, it bombards them with internal radiation. Its ray which cannot reach the reproductiv organs and genes, affect only the in dividual himself.

DEPOSITS RISING

Already some children have accumu lated a measurable amount of strontiur 90 in their bodies, presumably from th milk of cows that grazed on contamin ated pasturage. While the quantit detected in humans has been harmles so far, it is gradually rising, and wi bear watching. That warning, alertin official quarters some time ago, quietl mobilised an army of researchers an sped them to outposts near and far.

Aerial observers have been flyin planes to 45,000ft altitude, and sendin unmanned balloons to 100,000ft, t learn how much strontium 90 is stil floating aloft. What's come down ha been sampled in alfalfa, canned fish, an human bones. Facets of the far-flun project include a Pasture Program,

nip-Top Experiment, a Milk Pro-
m.
Newly promoted to the rank of scien
apparatus are 12-gallon army cook-
s of stainless steel; found the most
cient collectors of strontium 90 in fall-
, they've been set out on rooftops
the AEC's New York City building
l elsewhere.
First returns now are in. Even if
nb tests in all countries were stopped
ay, they show, strontium 90 would
tinue to accumulate in the soil, and
ch a maximum about 10 years from
v. For only a fourth of the stron-
n 90 from past tests has settled to
th so far; the rest, now floating high
the stratosphere, has still to come
wn.

RMISSIBLE LIMIT

ust from bomb tests already made
within perhaps a decade, it's pos-
le that the strontium 90 in people's
nes may reach a maximum figure of
pc of the permissible limit, predicts
rril Eisenbud, manager of the AEC's
w York Operations Office. It's also
sible, he adds, that estimate may be
times too high, for his calculation in-
ved many still-uncertain factors, and
purposely used the most pessimistic
ures.
Then, too, the "permissible limit" itself
e-ten-millionth of a curie of radio-
ive strontium in the human body, the
ommended limit for the general pub-
is a highly arbitrary one that may
far on the safe side.
Despite those qualifications, it's now
ar that we're much nearer the advis-
e limit for strontium 90 than for the
t of fallout's radioactivity.
Our margin of safety still is wide. But
narked acceleration in the current rate
bomb testing could narrow it to a
s comfortable one.
In case of an all-out nuclear war, in-
asing fall-out a thousand-fold or
re, it's even possible that the safety
rgin could vanish altogether. Then
re might be real danger of bone
ncer from strontium 90 — especially
ong those who were babies at the
e, and whose growing bodies would
exposed to the bulk of a war's fall-
t a decade or so later. To meet the
longed postwar emergency that con-
vably could arise, large-scale decon-
ination of food might be necessary

N EXCHANGE

To be forehanded, the AEC has
eady been doing some research along
t line. A recent and promising ex-
iment, upon milk artificially con-
inated with strontium 90, showed
t the milk could be completely puri-
d by an "ion-exchange" treatment with
aterial called Dowex-50 W resin. The
thod also removes the milk's calcium.
ich would need to be replaced after-
rd by adding a suitable calcium salt
the decontaminated milk.
Scientists of Project Sunshine, which
now grown to an international pro-
t, with many countries participating,
ject to fix more precisely the stron-
n 90 safety limit and the nearness of
approach toward it. Then, what to
about it will be up to the world's
ions to decide.
Meanwhile, the US is taking steps to
it the strontium 90 loosed upon the
rld by its own tests. Besides moderat-
the scale of H-bomb testing since the
bangs of 1954, the AEC last year
announced successful trial of a "clean" H-bomb — in its own words, "a mega-tonrange weapon with an inherently smaller amount of fallout for a given energy release". But if the Russians and others prefer to stick to "dirty" bombs, that's beyond our control.

Just what is this newly important strontium 90?

Strontium has long appeared on the list of chemical elements. It takes its name, as does the mineral strontianite that yields it, from the site of the mineral's discovery: Strontian, Scotland.

It's a silver-white metal, but you're more apt to see it in the form of white compounds like strontium carbonate and strontium nitrate; the latter imparts a red color to fireworks and signal flares.

Ordinary strontium metal and its compounds are neither radioactive, nor especially toxic. They contain several natural "isotopes" or varieties of strontium, mostly one called strontium 88.

The black-sheep strontium 90 looks, and acts chemically, exactly like the innocent natural kind. So do its compounds. The big differences are its dangerous radioactivity and the fact that it's a man-made isotope, not occurring in nature.

It's one of the 160-odd radioactive fission products created by nuclear bombs and by uranium-fuelled nuclear reactors. It also is one of the longest lived — retaining half its radioactivity for 28 years. Eventually, strontium 90 turns into nonradioactive zirconium 90, identical with the kind you dig in a mine.

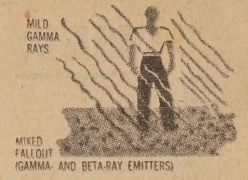
STRONTIUM IN SOIL

Probably most of the strontium 90 that fallout has deposited in the soil is in the form of white strontium carbonate. Fallout over all of the US to date has amounted to no more than a scant 10 ounces of this compound, a bottleful that you could stuff in an overcoat pocket. Scattered over 3-million square miles, that seems a mighty tiny amount — but a little goes a long way.

Recent years have brought striking changes in the behavior of fallout. How it gets from bombs to you is a story that throws more light on strontium 90—and on the other much-discussed ingredients of fallout, too.

One March day in 1954 a destroyer detached from a US task force raced at

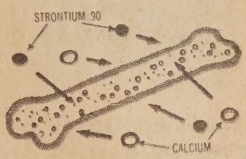
HOW IT CAN KILL



Gamma rays from fall-out on the ground irradiate you mildly. Short-range beta rays of long-lived strontium 90 can't yet reach you.

Plants absorb strontium 90 in drawing up minerals from the soil. Cattle that graze upon the plants pick up the strontium in turn.

Milk and cheese, calcium-rich, will also contain the calcium-like strontium 90 eaten by cows, and pass it along to your table.



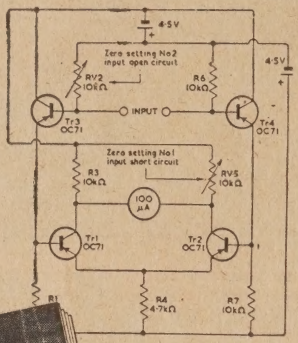
Mistaking strontium 90 for needed calcium, human bones take up both, and so become the target of strontium's radioactivity.

"STRONTIUM POT" of stainless steel is set out on roof of AEC's New York building to measure amount of descending strontium 90. Pot collects a week's dust and rain, fallout included.

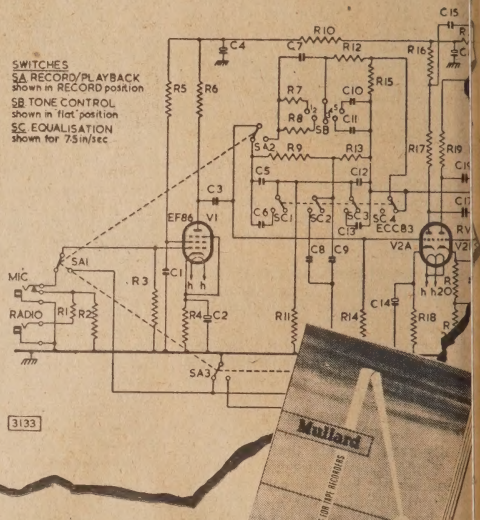
CONTENTS OF POT are rinsed and scrubbed into beaker, to be evaporated down to a residue of brownish-black mud, from which strontium is chemically separated and its amount determined.

2 NEW PUBLICATIONS FROM Mullard

only the top of the wedge is fluorescent, and then that too becomes cut off; the dot is the last part of the display to be extinguished.
When the bridge is balanced, there is zero input, the 'eye' is open and gives the full 'exclamation mark' display.



nplification of nearly a', thus causing a voltage meter which is proportional to the applied



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speed to the atoll of Rongelap in Marshall Islands. Hustled aboard n more haste than ceremony were 64 ildered natives, young and old. Then warship dashed away.

ome hours earlier and 100 miles y the record-size H-bomb had been oded. Shifting unexpectedly, the wind e the radioactive cloud toward sup edly safe Rongelap.

now began falling on the island—a nge atomic snow of fine, sticky white icles. It consisted of slaked lime, n bomb-pulverised and incinerated fission products that had condensed n it.

OWY FALLOUT

ty the time the rescue ship arrived, snowy fallout coating the ground already exposed Rongelap's inhabi- s to 175 roentgens of radiation, near- half the average fatal dose of 400 ntgens. Had they remained on the l a few hours longer most would e perished. As it was, all recovered. hat dramatic episode illustrates one of fallout—the visible and concen- ed "local" kind, of coarse particles settle to earth within a few hours.

s radioactivity is so intense that its erful gamma rays are the outstand- peril. Fortunately, this kind of fall- extends less than 250 miles down- d from the biggest bombs of all.

lore interesting to most of the world second kind of fallout, a "distant" invisible kind. Its particles likewise coated with radioactive fission pro- ts, but are of microscopic size.

Vindborne for weeks in the tropo- ere, the lowest or "weather" layer of atmosphere, this bomb dust may le the globe two or three times. When comes down to earth, borne mostly rain or snow, much of its radioactiv- has died out. Enough remains to ke uranium-hunters' Geiger counters ely proclaim a bonanza — and to ter makers of photographic film. ch fallout threatens to fog. From the ture of fallout ingredients strewn n the ground, mild gamma radiation nbards people. Long after this has ndled away, the insidious strontium still lurks in the soil.

t 88 monitoring stations, in the USA 45 others, the AEC has been keep- tabs on the "mixed" fallout by col- ing it on squares of gummed film measuring its overall radioactivity.

t has been a little heavier in the US n in any other country, the records w.

FECT ON LIFE.

Does this fallout's gamma radiation aten to cause genetic damage, or to rten your life, as even small doses believed to do? How slight your osure actually is has now been shown the NAS report. The external radia- n that an average American may ex- ts to receive during the next 30 years, s the NAS, breaks down as follows: m natural radioactivity, 58.1 pc; from dical and dental x-rays, counting only stray radiation that reaches the es, 40.6 pc; from fallout, a mere 1.3

Natural radioactivity itself ranks well ew the permissible external-radiation e — even a drastic low one newly set the general public. And so the much aller external dose from fallout isn't n in the running.

A third kind of fallout, entirely new and different, remains to be described. It has resulted from the first H-bomb of 1952, and subsequent ones. For super-bombs of megaton size blow at least half of their radioactive particles clear into the stratosphere, 55,000 feet or more up. And then it's a matter of years before the fallout comes down; nearly 10 years on the average.

By then virtually all it contains of interest is long-lived strontium 90. (Cesium 137, principal gamma-ray emitter among fission products a year or more old, is so mildly radioactive as to be relatively harmless.)

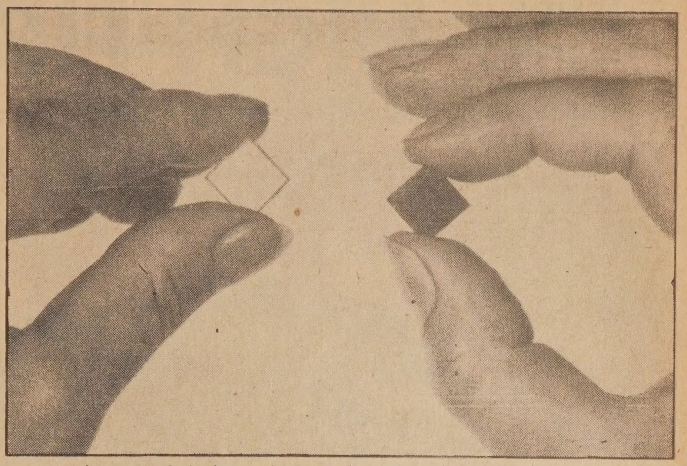
Distributed over the earth extremely uniformly, this new kind of fallout is just beginning to have substantial effect.

Since 1955, monitoring stations report, it's become impossible to tell from which bomb-test series a given day's fallout sample came—the old fallout particles are now intermingling with the new.

MORE TO COME

From this stratospheric reservoir the bulk of strontium 90 from past bomb tests has still to fall upon us. And the problem is becoming urgent of gauging whether any heavier pollution of the world's upper story would return to plague us in years to come.

SIMPLE DETECTOR OF DANGER



A simple means of checking radiation is this special glass which changes color when exposed to radiation. It has been issued to research workers and others in potential danger as a locket to be worn around the neck. It consists of silver-activated phosphate glass.

TV MAKES PROGRESS IN MEDICINE

Television as entertainment holds the stage at present in Australia, but overseas great strides have been made in its use in other fields. It is rapidly developing new techniques in many important industrial and sociological fields.

THE increasingly important role of television in the field of medicine is pointed up by two recent developments.

One is a new application of closed-circuit TV that provides immediate comparative data of chemical activity within live normal and cancer cells.

The other part is the start of commercial production of the first compatible color TV camera system designed specifically for medical use.

Closed-circuit TV is one of the most dramatic of a whole host of marvellous mechanisms of electronics that are fashioning a better world for medicine. In this new era of medical electronics, conventional instruments like the stethoscope—traditional badge of the physician for more than a century—seem likely to give way eventually to diagnostic robots with years of medical skill built right in.

Electronics has already provided the electron miscroscope, x-ray systems, the television microscope, infra-red and ultrasonic equipment, and an imposing array of measuring devices, such as electronic particle counters, radiation meters and electro-cardiographs.

Over the years, scientists and engineers have led the way in adapting electronics to the special needs of medicine, and the two new television developments are the latest of a long line of medical devices.

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2. As above, but with Diamond L.P Stylus	£19/15/
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4. As above, but with Diamond L.P. Stylus	£22/15/

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SIMPLE ELECTRONIC PRINTING

This is an extract from a report by Meyer L. Sugarman Jn. of the RCA Research Laboratories concerning a novel method of printing and duplicating. It is simple and rapid to use, has high sensitivity and develops in a dry condition. It can handle a wide range of printed material.

The electrostatic charge is placed on the sheet by a hand-held corona unit operating from a harmless 6000 volt supply unit. In this condition it is sensitive to light

In the past few years rapid strides ave been made in the new field of ectrophotography, or electrostatic hotography. Practical achievements ius far promise to furnish valuable ipplements to silver halide and other hotosensitive materials now used in ontinuous tone photography, office opying and duplication, photo-engraving nd other photo-resist applications, and many other fields.

The system to be described here is nown as "Electrofax". The photo-ensitive element in this system is a mix-ire of a powdered photoconductor in resin binder, which may be easily coat-d on practically any base, from paper r plastics to a metallic sheet. Such coating is insensitive to light unless lectrically charged, but attains usable hotographic properties when an elec-ro-static charge is placed upon its sur ace.

In order for such a system to be com-iercially practical, the photoconductor hould be inexpensive, easily handled nd non-toxic. A special grade of zinc xide in a resin binder, has been found meet all of these requirements. When oated upon an ordinary, thin flexible aper base, the mixture is the basis for n electrophotographic printing paper ossessing the photographic speed and iany other characteristics of silver hal-de printing papers, but having a dis-inct advantage in cost, shelf life, and ack of light sensitivity until electrically harged.

Whether used as a direct printing aper or in a graphic arts application, he basic Electrofax electrophotographic rinting process consists of the same four imple steps. These are:

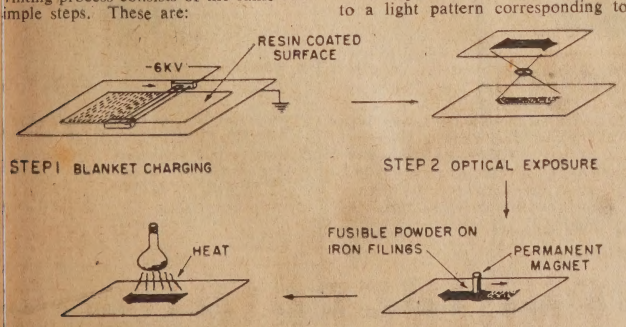
1. Placing a uniform electrostatic charge on the photoconductor-resin coated surface in the dark or under suitable safelights. This is accomplished by use of a corona discharge from an array of fine wires connected to the negative terminal of a 4 to 7 kilovolt d-c source. A grounded plate beneath the electrophotographic coating is connected to the positive side of the source.

2. Exposure of the charged surface to a light pattern corresponding to the image to be reproduced. Since the final result is a positive-to-positive photographic reproduction of the original, this may be a reflected image projected by suitable optics from a line drawing or continuous tone original. In this step, the electrical charge flows away from the photoconductive surface in proportion to the light incident upon a given unit area, thus leaving a latent electrostatic charge image corresponding to the light values in the original.

3. Developing the latent electrostatic image with a suitable positively-charged powdered material. In the experiments described here this material is a finely divided thermoplastic pigmented resin powder. This powder is so compounded as to take on a strongly positive static electrical charge when contacted with or rubbed against, powdered iron.

In the Electrofax system, development of a visible image is accomplished by mechanically rubbing the surface of the zinc oxide resin layer carrying the negatively charged latent electrostatic image with a "magnetic brush" consisting of a mass of iron powder mixed with the developing powder and carried on the end of a permanent magnet.

Contact and rubbing between the iron and developer powder surfaces cause the former to take on a negative and the latter a positive charge. Due to attraction by the stronger negative elec-



Steps in the electrophotographic printing by the Electrofax method.

PHILIPS TV

MEASURING EQUIPMENT

3 INSTRUMENTS FROM THE EXTENSIVE RANGE OF PHILIPS MEASURING APPARATUS FOR TV AND ELECTRONICS

GM2891

SYNCHRONISING SERVICE PATTERN GENERATOR
Frequency range in two bands—40-80 Mc/s, 170-220 Mc/s.
Modulation: Vertical and/or horizontal bars, variable in number and cross hatch.
Frequency modulated sound carrier at carrier separation of 5.5 Mc/s; sound tone variable.
Synchronisation: Either mains locked or free running.

GM2889

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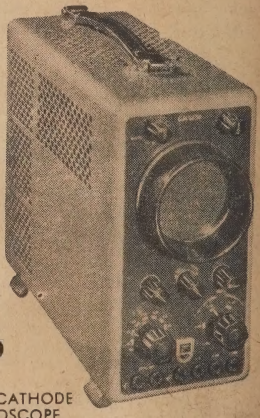
Frequency range from 5 to 225 Mc/s. Built-in marker and crystal calibration oscillator.
Three controlled ranges of frequency deviation to 15 Mc/s (± 7.5 Mc/s).
AM 400 c/s or externally to 10 Mc/s.
FM and AM may be used simultaneously.



GM5650

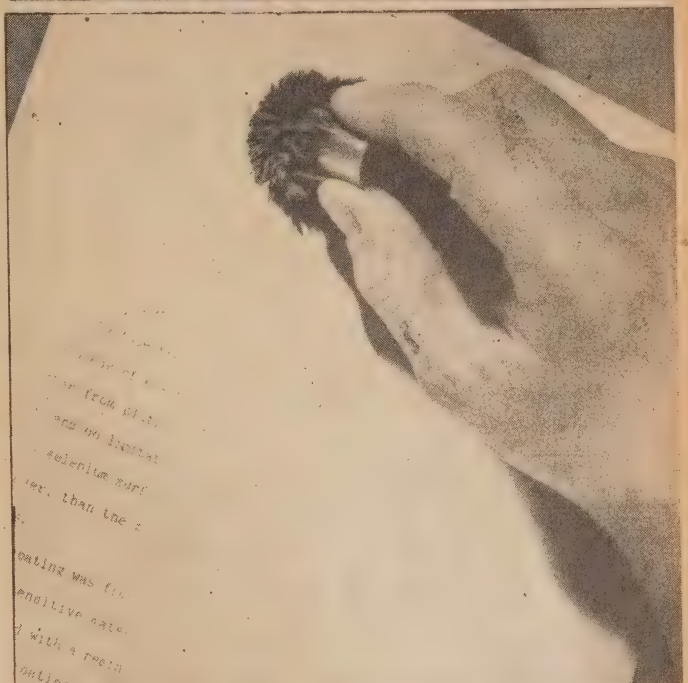
WIDE BAND MINIATURE CATHODE RAY OSCILLOSCOPE
7 cm. (3") C.R. tube.

Symmetrical amplifier in two switched band widths: D.C.—1 Mc/s (3db 300 Kc/s) sensitivity 10 mV/cm.; D.C.—10 Mc/s (3db 3 Mc/s), sensitivity 100 mV/cm. Triggered or free running, time base in eight ranges. 10 c/s to 300 Kc/s (15 millisecond/cm. to 0.5 microsecond/cm.), allowing expansion of 1 microsecond pulse to 2 cm. display width. Calibrated lattice and attenuator for voltage measurement.

PHILIPS ELECTRICAL INDUSTRIES PTY. LIMITED— Sydney · Melbourne · Adelaide · Brisbane · Perth · Hobart

PG28.57

IRON DUST PRODUCES AN IMAGE



As the developing brush is rubbed over the exposed sheet, the developing powder clings to the electrostatically charged image.

ostatic charges on the photoconductor rface, the developing powder particles ave the iron and deposit in the image reas.

In the illustration of a typical "mag. tic brush" suitable for producing hand ints, it is to be noted that the iron ristles" follow the magnetic lines of rce.

Mechanical arrangements using more mplex magnetic structures have given od results in continuous development strip microfilm enlargements and other perimental mechanised printing rangements.

4. Fixing the developed image. The ermoplastic powder image is now fix- by melting it on to or through the ne oxide-resin surface. This may be one in the light, since electrostatic at- action will hold the powder image in face for some time without auxiliary rmanent fixing. Of course, other fix- g methods such has solvent vapor of essure methods may be used.

RASURE

If desired, the image may be erased ter step 3 by first exposing to a strong, iform light to cause the charge to flow if under the developed areas, then erely rubbing with the magnetic brush pick up the released powder from the notosensitive surface.

In addition, since the photoconduc- ve properties of the zinc oxide-resin ating are not permanently affected the electrical charging or heat-fixing ocesses, additional copy may be added a fixed print at any future time by simple repetition of the four basic eps outlined above.

Electrofax type coatings, as exempli- ed by a zinc oxide-resin mixture, re- ond to dye sensitisation.

The basic response of the photocon- uctor which, in the case of zinc oxide primarily in the ultraviolet and far ue regions of the spectrum, may be tended into the visible by the addition sensitising dyes.

A wide range of dyes has been found be absorbed to the zinc oxide sur- ce, and to transfer sufficient energy om wavelengths absorbed by the dye extend the effective spectral response.

Left — a hand magnetic brush suitable for developing Electrofax images. The powdered iron particles, loaded with positively charged fusible toner powder follow the magnetic lines of force, thus forming a brush-like structure. Right — actual size sample of Electrofax printing illustrating fine definition.

Since the electrophotographic process is electrical in nature, rather than chemical, many dyes which cause fogging or desensitjsation in silver halide emulsions are effective sensitisers in electrophotographic coating mixtures.

The sensitometry of Electrofax coatings has yet to be investigated thoroughly. However, preliminary work, consisting largely of simultaneous step-wedge exposures, indicate that the speed and contrast range of the unsensitised zinc oxide-resin coating when exposed with tungsten light are roughly equivalent to a contrast 4 silver halide contact printing paper possessing an ASA paper speed of 16. The effective tungsten speed of a typical sensitised coating is about 30 times this value.

The Electrofax process is thus in the intrinsic silver halide photographic sensitivity range and furnishes speeds thousands of times those of the usual diazo, bichromate, or light-sensitive plastic processes.

Typical experimental exposure requirements for contact printing on unsensitised coatings are one to two seconds to two 4-watt white fluorescent lamps at 20 inches.

This is reduced to about 1-10 second by substitution of two 4-watt black-light lamps, with their high output in the intrinsic ultraviolet sensitivity range of the zinc oxide photoconductor. A 100-watt incandescent lamp in the same position requires about ½ to 1 second to discharge the background areas of an unsensitised coating.

Projecting printing is easily possible. A prototype microfilm printer built at the RCA Laboratories produces 8½ x 11 pints from 35mm microfilm using a 1-second exposure through an f.8 lens with a 300-watt projection lamp.

Experimental outdoor exposures in bright sunlight in an adapted camera have produced prints on rose bengal sensitized paper with exposures of 1-5 to ½ second at f.4.5 This corresponds roughly to an ASA film exposure index of about 0.5.

The WARBURTON FRANKI Page

Check it each month for all your Radio and Television Needs

TOP QUALITY CIRCUIT TESTERS AT TOP VALUE PRICES . . .

● MODEL TK30-A

Dimension: 99 x 55 x 35 m/m
Model TK-30 is a midget size individual jack type circuit tester with a color plastic panel and cabinet.
D.C. Volts: 15/150/750V (1000 ohms/V)
A.C. Volts: 15/150/750V (1000 ohms/V)
D.C. Current: 150 mA
Resistance: 100 K ohm (By 1.5V internal battery) **£5/15/-**

● MODEL TK-50 £8/19/6

Dimension: 120 x 90 x 40 m/m.
Model TK-50 is a pocket size individual jack type circuit tester with an insulated panel and steel cabinet.
D.C. Volts: 10/250/500/1000V (1000 ohm/V)
A.C. Volts: 10/250/500/1000V (1000 ohm/V)
D.C. Current: 1/250 mA
Resistance: :10/100 K ohm (By 1.5V internal battery)

● MODEL TK-70 £12/15/-

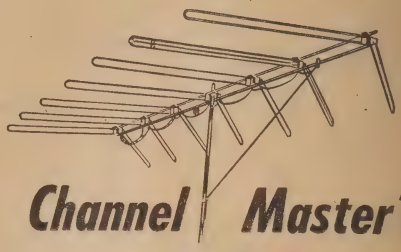
Size: 140 x 92 x 38 m/m
Model TK-70 is a pocket size rotary switch type circuit tester with an insulated panel and steel cabinet.
D.C. Volts: 10/50/250/500/1000V (2000 ohm/V)
A.C. Volts:: 10/50/250/500/1000V (2000 ohm/V)
D.C. Current: 500 u A/25/500mA
Resistance: 10K ohm/1 Mg.ohm (By 3V internal battery)
Decibels: — 20 to + 22db
20 to + 36db

● MODEL TK-90

Size 100 x 150 x 70 m/m.
Model TK-90 is a handy size rotary switch type circuit tester with a black bakelite panel and cabinet, having a high sensitivity 45 uA meter 20.000 ohms per volts on D.C. and 8.000 ohms per volts on A.C.
D.C. volts: 10/50/250/500/1000V 5000V (20.000 ohms/V)
A.C. volts:: 10/50/250/500/1000V (8000 ohm/V)
D.C. Current: 50 uA/2.5/25/250 mA.
Resistance: 5/50/500 K.ohm/5MG ohm (By 3V internal battery)
Decibels: —20 to + 5db
(Odb — 0775V — 600 ohm)
+5 to + 22db **£15/15/-**

CLEARANCE Well-known brand
3-SPEED RECORD CHANGER
Limited quantity to clear at . . . **£15.19.6**

A COMPLETELY NEW KIND OF T.V. AERIAL



Channel Master's T-W

The Travelling Wave

★ **HIGHEST GAINS . . .**

★ **HIGHEST FRONT-TO-BACK RATIOS . .**

★ **STRONGEST CONSTRUCTION . . .**
ever achieved in a T.V. Aerial

- Six of its seven elements are "driven".
- Its phasing harness is in two sections, each with a different impedance.
- All dipoles have a different length.
- Two different "Veeing" angles are used.
- A terminating resistor is employed.
- No conventional folded dipole are used:- One is a CTD (Controlled Impedance Dipole), a new type 3-conductor high impedance dipole with a unique "shorting bar." — Five are "hairpin" or "fat" dipoles. — One is a folded reflector.

What the Travelling Wave Principle Means

● **Ideal phase relationships on all channels.** ● **Optimum impedance on all channels.** ● **Equal flow of current in all dipoles on all channels.** ● **Fullest use of transmitted energy on al channels.**

SENSATIONAL POWER There's never been an all-channel aerial like it. A single-bay T-W 350 (7 element) OUTPERFORMS:- Stacked Champion . . Super Rainbow . . Any stacked 10-element Yagi on each high band channel . . Any wide-spaced 5-element Yagi on each low-band channel.

SUPER STRENGTH is inherent in the very design of the T-W. The physical strength of every component of the antenna is amplified by truss construction. There are NO straight elements. Every T-W element is folded and therefore, in effect, a truss, more than 5 times stronger than an ordinary straight dipole. Even the crossarm, the completely new TWIN BOOM, is a truss joining a conventional crossarm to a second rugged full-length boom.

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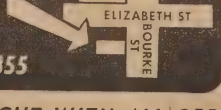

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SCIENTISTS ARE OOKING TOWARD THE SUN

Amazing technical and scientific advances are forecast in the next few years by research workers all over the world. Some of them are likely to have a profound effect on our general way of life. All of them have been seen in experimental form, and some are already on the way to achievement.

SOME of the developments we should see in the near future include: —

. Extensive uses of radioactive topes for food sterilisation and preser-on, for minute measurements, for ring oil flow or machine wear, for ant studies and a wide variety of other ustrial uses.

. New methods for demineralising water to meet a tremendous future mand for water.

. Man-made diamonds for industry, ich uses approximately 11-million rats annually, or about 2½ tons worth arly 35-million dollars.

. The x-ray microscope which can "see" inside materials.

There is certain to be increased engi-ering emphasis in the field of solar ergy.

With enormous amounts of solar ergy coming to us free, scientists feel ey should go to considerable lengths capture substantial quantities of this ergy.

LIMIT TO FUEL

There is a limit to fossil fuels—coal, l and natural gas—and even the limited anium fuels. Man is turning to the n, which, after all, is actually a pro-ious nuclear reactor producing vast antities of power.

The sun pours on to the average usetop in a sunny clime more than a ndred times as much energy as the use receives via the electric power es.

A solar reflector 33ft in diameter uld be used as a steam generator to oduce as much as 100lb of steam per ur at 100lb per square inch pressure.

Scientists envision housetop solar bat-ries as flat-plate collectors consisting of e or more layers of glass placed over me good solar-energy absorbing aterials, with a space between them.

The collector is generally a stationary vice set at an angle to best receive e sunshine. Air, water or some other uid is pumped through the space be-een the heat absorber and the glass over.

The heat absorbing panels also serve the roof itself. The heated fluid is en used to warm the house, or it can e used to drive some form of heat gine to pump water or perform some her work like cooling the house in mmer.

Scientists and engineers have been fas-nated by the idea of making collectors ith cheap, unfabricated materials such s water or living organisms.

Plants are able to carry out the pro-ess of photosynthesis—that of convert-ing solar radiation into chemical energy. While there is still much to be learned about such processes, there may be the future possibility of controlled growing of simple plant forms to convert the energy from the sun.

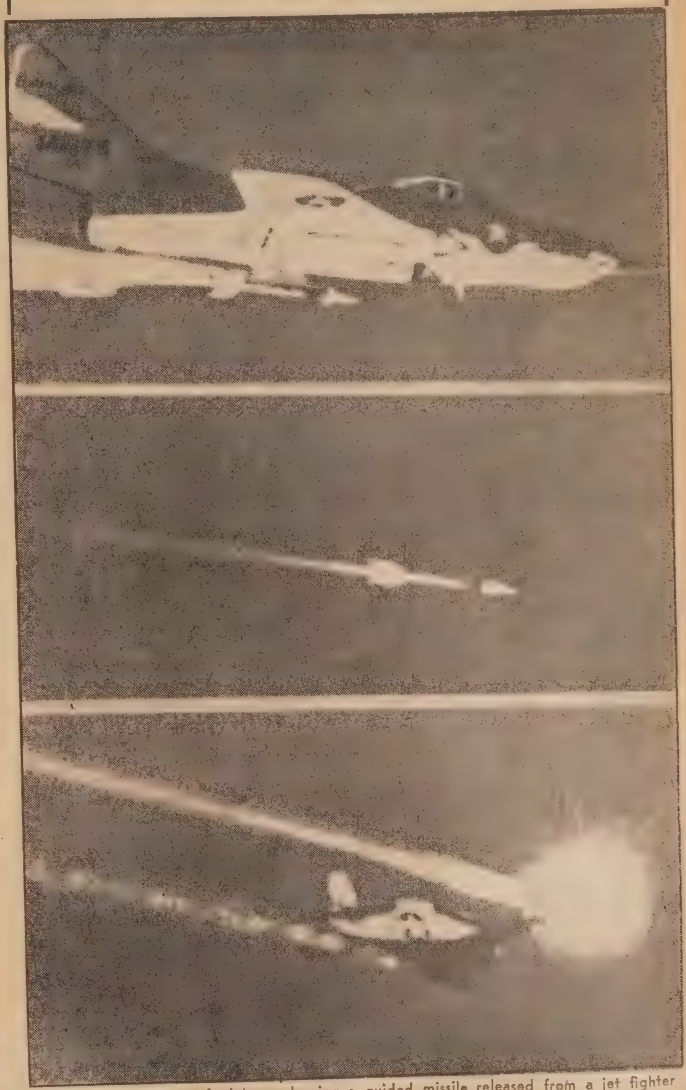
Some day we should have transis-torised solar-powered radio receivers. Such sets would have solar batteries capable of storing enough energy from the sun to power the receiver for 500 hours in total darkness.

The widening peacetime use of atomic by-products, notably radioactive isotopes, may lead to the next startling revolution in food preservation.

Engineers are studying the possibility of beaming high-intensity gamma-ray isotopes at packaged food as it passes on conveyer belts.

There are still problems. Some foods sterilised in this manner taste, smell or look terrible. Nevertheless, gamma irradiation has a tremendous future not only in the food industry ,but also in irradiating chemicals and plastics to make new materials with unusual properties.

GUIDED MISSILE FINDS A TARGET



A remarkable series of pictures showing a guided missile released from a jet fighter over the Mojave Desert in California, streaking on its way to explode beside a target drogue plane in tests last month. They demonstrate with great force the deadly nature of these new weapons.

RADIOTRON
TELEVISION VALVE SERIE

The two most important requirements of the r-f amplifier of a TV receiver are high gain and low noise. High gain is necessary to provide good sensitivity and to ensure that at the converter grid the signal is large compared with the noise voltage. Low noise is important since under weak signal conditions the noise contributed by the stage may have the same amplitude as that of the signal.

In addition the r-f amplifying valve should have:

(a) high input resistance to allow the antenna-to-grid matching circuit to step-up the impedance, and thus the voltage, from antenna to grid;

(b) low coupling between input and output circuit, to give both low oscillator radiation and good stability;

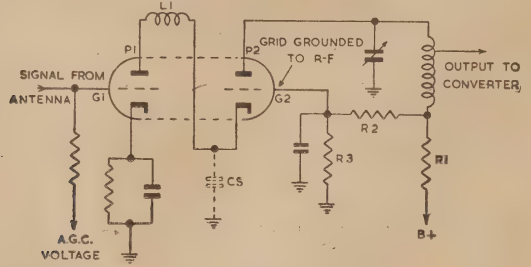
(c) suitability for a.g.c. application, i.e. should be capable of having its gain varied over a wide range by the a.g.c. voltage with as little disturbance as possible to input impedance or circuit tuning;

(d) small cross-modulation factor to avoid "sound on vision" or "vision on sound" effects and also to avoid interference by a strong adjacent carrier.

To obtain a low noise level it is not desirable to use a pentode because the random division of current between plate and screen results in a substantial increase of noise over that occurring in a triode.

A conventional triode amplifier however has the disadvantage of high coupling between input and output circuits which seriously limits the maximum stable gain and gives poor suppression of oscillator radiation.

The advantages of both triode and pentode are nevertheless obtainable in the "cascode" circuit which uses a high performance twin triode in a driven grounded-grid arrangement of which the simplified circuit below is one example.



L1 is series resonant with Cs at frequencies above 220 Mc/s to produce low impedance between plate P1 and earth and hence reduce plate-to-grid feedback.

R1, R2 and R3 are adjusted to provide appropriate variation in bias on G2 as signal input and a.g.c. to G1 vary. Cs is the stray capacity between cathode and earth.

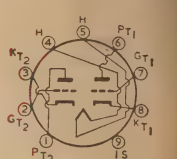
The overall gain obtained in such a circuit is higher than that of a pentode, particularly at the 200 Mc/s end of the TV band because amplification is obtained from the two series-connected triodes and it is accompanied by the characteristically low noise of the triode. Good a.g.c. and cross-modulation are obtained with the circuit because as the a.g.c. voltage is applied to the grid of the first triode its plate voltage rises, thus increasing the bias necessary to cut-off its plate current, and at the same time, depending on the point to which the second grid is connected, increases the bias on the second triode. The overall effect of the a.g.c. voltage therefore is to make the cut-off characteristic of the 1st triode more remote and to obtain some control from the 2nd triode thus giving a smooth and effective a.g.c. action and freedom from cross-modulation effects. The circuit also allows very little oscillator radiation back through the r-f amplifier.

The Radiotron 6BQ7A has been designed for use in cascode circuits such as that described and has special shielding to produce low capacitive coupling between each half of the valve which this circuit requires. The valve also has a high ratio of gm to input-plus-output capacitance and to plate current, both of which are required for high gain and low noise.

† For further information on the 6BQ7A and other Radiotron Television Valves consult the Radiotron TV1 Booklet. Additional copies are available free and post free on request.

6BQ7A †

SOCKET CONNECTIONS



(bottom view)

Pin 1 — Plate of Unit No. 2.
Pin 2 — Grid of Unit No. 2.
Pin 3 — Cathode of Unit No. 2.
Pin 4 — Heater.
Pin 5 — Heater.
Pin 6 — Plate of Unit No. 1.
Pin 7 — Grid of Unit No. 1.
Pin 8 — Cathode of Unit No. 1.
Pin 9 — Internal Shield.

AWV
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TRAINING IN MAKEUP FOR TV

AT Ealing Studios, the BBC has a TV make-up school where training an be received in the art of providing make-up for all types of TV appearnces. Applicants, who must have had ome previous training as a hairdresser, eautician, etc. receive a three months' ourse in make-up, wig and beard-making, mask-making and the many other rts required for both straight and character parts. After training, students are ble to handle any problems which arise n the production of programs at Lime Grove.

The picture above shows a trainee at he school putting the finishing touches to a clown make-up. Unrecognisable under his test piece is a fellow student.

☆ ★ ☆

THE popularity of color pictures is growing every year, and the 35 mm projector is appearing in millions of homes. This latest idea of a combined coffee table and color projector comes from London where the public saw it for the first time at the Photo Fair held in Olympia, Earl's Court, on April 11 and 12 of this year.

It is designed to make the setup for projection easier and more convenient, and to popularise the habit of examining one's pictures during a pleasant hour with one's friends.

Music Hath Powe To Soothe...!

Music and movement have always played a big part in human history. The first Australians had their corroborees. Today's Australians work off their energy more strenuously.

The power of music to modify the condition and behavior of the individual has been recognised for years, and it is now being examined and exploited in many fields. Industry has used music for many years, and now medicine is finding an unexpected source of assistance from it.

"IS there a heart which music cannot melt? Alas! How is that rugged heart forlorn!"

That phrase was written years ago by Beattie in his book "The Minstrel".

How true it is. There cannot be a heart which is not influenced in some way by music.

The story of music goes hand in hand with the story of the origin of man. Long before the invention of musical instruments people chanted songs and answered each other through the hills with musical calls and notes.

Primitive natives in the jungles even today are influenced by the chants which they utter during their ceremonies.

The native medicine men of old and those of today rely on the power of their music to gain certain effects on the members of their tribes.

It will be shown that the civilised "medicine men" of today have found a power in music to aid them in their efforts of cure.

Music affects individuals in many different ways. To some it means "Rock 'n' Roll" with its attendent wild gyrations. It means you are "sent" and to the opposite school they have a pretty good idea of where one is "sent" to.

To others it means peace and calm and meditation which means to the

by Calvin Walters

Rock 'n' Roll enthusiast gloom and s ness.

There are others in between who tolerate anything. Perhaps these are happiest because they have no viol reactions either way and are m easily entertained.

In Biblical times music played a gr part in the lives of the people. We r of Jubal who was the "father of those that handle the harp and organ". We also read of the temple King Solomon where there were th sands of priests with trumpets, harps a psalteries togethe with those who sa beside the altars to the accompanim of harps and so on. What a row th must have made yet everyone seemed enjoy it all.

It is not generally known that t Psalms of the Bible are really the wo of songs sung by choirs.

HEALING THE SICK

When music began to be used in t healing of the sick is not known. It certain that it began in the very earli of times by primitive people and h continued to the present day as w nessed by many who have seen t ceremonies conducted by natives to he the sick of their tribes. That it has undoubted effect has been proved m conclusively.

In recent year experiments have be conducted on an increasing scale to te the physiological effects of music on t individual.

Various instruments have been d vised with which these tests have be conducted. All these prove that mus affects us physically.

We also know that music affects psychologically. It has a distinct effe on our mental attitude. Not only a human beings affected this way b every living thing seems in some wa influenced by music.

The type of music you like seems have something to do with what sort a person you are. Emotional music favored by emotional people. Aggressiv people like aggressive music such military marches and so on. Highly in tellectual people find interest in com plicated "highbrow" music which re quires analysis. Simple minded peopl favor simple melodious or "pretty music which requires no thought activ ities. Boisterous people like noisy musi like modern jazz, etc.

All this of course can lead to stron argument and will be bitterly oppose by some but speaking generally th

IT'S THE BIG ONE AT THE BACK!

Soothing music has been brought to the aid of doctors and dentists to calm patients under treatment.

sertion will be found to be true. What is normally detested by people will be tolerated if the circumstances are favorable. For instance if one is a "high-brow" enthusiast but likes dancing he will tolerate any kind of noisy jazz if he is attending a dance and thoroughly enjoy it, even entering spiritedly into a Rock 'n' Roll performance. At the same time if the band played (if it could) a symphonic work between dances he would appreciate it and look for more.

The reverse is not always true. The true jazz fiend usually cannot tolerate symphonic music of any sort.

If your neighbor plays the bagpipes every night you want to shoot him or move to another suburb. But bagpipes played at a Scotch gathering is really something to listen. It "stirs the blood" of everyone.

MUSIC AND RHYTHM

Why music effects living things in this way has been the subject for conjecture for centuries. Some of the theories advanced are worthy of attention.

One authority named Benedict claims that "Rhythms are for conducting our train of thought away from all unhappy things that beset us. They convert our thought impulses into mere motion. It is motion with no particular thought purpose. During a performance of rhythms the's intellectual processes are probably the nearest to being nil that one can arrive at outside of sleep. . .

Larson says, "It appears that the human organism participates in that tendency to vibrate synchronously with music which is known to obtain in the inanimate world". Rhythms may be heard, seen and felt and, according to Billroth, "rhythmic movements are among the most important properties of our body and are necessary to life". He claims that all muscular movements are brought about by a summation of numerous infinitesimal and imperceptible rhythms.

MUSIC AND THE MIND

One explanation as to why music has such a beneficial effect on certain types of mental illness was put forward many years ago by one Eva Vescelius. She says, "We are organised vibrations. The object of all cures is to change discordant vibrations to harmonious ones. Disease is unrhythmical, health is rhythmical, for rhythm is a fundamental law of the universe. . . Man's body is linked to his . . . spirit by means of his mind. Each of these vehicles sounds a keynote of its own. If these notes be altered so as to create a dissonance between the bodies great enough to cause a rupture between them the result is some form of mental derangement. Music in the correlated keys will prove beneficial in the treatment of these various forms of mental abberation . . ."

Eva Vescelius and others who followed carried out experiments and musical treatment of the insane more than sufficient to give a deal of support to their contentions.

One of the most interesting modern applications of music lies in the fields of medicine and dentistry where it is used in conjunction with anaesthesia and also to help the conditioning of the patient before operations.

This was a direct result of the observation that when music was played in hospital wards it helped to relax the patients, causing them to eat and sleep much better and hastening their convalescence.

The first experiments were conducted along the lines of providing music in the operating theatre in order to provide a pleasant distraction for the patient from the things going on around him, such as nurses running around with trays of knives, saws, chisels, forceps and other fearsome instruments. It took his mind off figures dressed like the Ku Klux Klan and the rattling of bottles and ejection of jets of steam from boilers and sterilisers.

It was soon found that the music enabled the patient to be anaesthetised more easily and he did not require so much pre-medication. Some patients even volunteered to do away with the anaesthetic for some minor operation. All I can say is that they must have used some pretty strong music for the latter.

This practice of using music in operating theatres, while not extensively used in Australia, is finding favor in other parts of the world.

When selecting the type of music played, various factors are carefully studied, such as the patient's temperament, religious training, education, his degree of fondness of music, and so on.

In dentistry the gas nitrous oxide is the most favored of anaesthetics but it is the least potent in that it is a weak anaesthetic when mixed with air. Seeing that it is necessary to supply air to the patient at the same time as the anaesthetic this leads to problems.

It has been found that at least 20 pc of air should be mixed with nitrous

Music while you work is now an established thing in modern industry.

GOOD RECORDING BEGINS WITH

BASF Long Play Recording Tape

MAGNETOPHON

TYPE LGS RECORDING TAPE WITH LUVITHERM BAS

Eight out of the ten major Recording Studios in Australia use BASF type L.G.S. Tape for the first step in the production of high grade L.P. discs.

3000'	on 10½"	spool	Price on request
1800'	„ 7"	„	95/6
1200'	„ 5¾"	„	65/-
600'	„ 4"	„	37/6
220'	„ 3"	„	21/-

SPECIFICATION	"STANDARD"	"LONG PLAYING
Width:	0.25" + 0 — 0.004"	0.25" + 0 — 0.004
Thickness of Base Film:	0.0015"	0.0009"
Thickness of Coating:	0.0005"	0.0005"
Tensile Strength:	7½ lbs. per ¼" width	5 lbs. per ¼" widt
Elastic Elongation.	At 1 lb load. less than 0.5%	At 7/10 lb load. l than 0.5%
	(1 minute application)	(1 minute applicatio

Magnetic Properties: Coercive force approx. 300 Oersteds.
Frequency Response: Recording and playing back frequency more than 15 Kcs at a tape speed of 7.5"/sec.
Modulation Noise: More than 50 db below peak modulation (measured as DC magnetisation)
Basic Noise: From a tape erased in the normal manner is at least 65 db below recording level.
Erasure: Under normal erasing conditions more than 65 db.
Print: Exceeding 60 db after close contact for 5 minutes.

★ SEALED PACK.

★ Each tape is individually sealed and fitted with coloured leaders (green at beginning and red at conclusion).

★ Each tape metal—striped at the beginning—if you require, it will operate on "automatic stop recorder".

STANDARD TAPE

2400ft	on 10½in	spool	Price on request
1200ft	on 7in	spool	67/6
850ft	on 5¾in	spool	59/4
600ft	on 5in	spool	39/6
400ft	on 4in	spool	34/-

Distributed by Maurice Chapman & Co. Pty. Ltd., 31 Macquarie Place, Sydney. Telegrams "Chappy". Phones BU3615, BU6401, BU5995.

BASF

NEW FIGHTER FOR FRENCH FORCE

The second prototype of the delta-wing interception plane "Nord Griffen 2" which recently made its maiden flight. This single seater French fighter is equipped with a combination jet unit. A horizontal surface is installed on the fore part of the aircraft for the purpose of stability. The fighter will soon be in production for the French Air Force.

e to be safe. However, because the
nt is usually under some tension
is fearful to some extent if not in a
plete "funk" (we all know how it
to get in the dentist's chair), his
en requirements are raised. He will
most likely require a greater con-
ration of gas than usual to "send
off".

he usual thing to do is to give the
ent some sort of premedication such
injection of a hypnotic drug. This
uite effective but increases the time
n to carry out the operation because
drug must be given time to act and
patient must hang around afterwards
ting for the effects of the drug to
r off.

should imagine that the sooner one
get the patient's money and let him
ir out the better, but the patient's
nfort and safety is the main factor

ypnosis has been thought of, but
raises legal difficulties. In addition
this, there is a likelihood that some
ients may be difficult to wake and
re is a danger that some people may
back to work dopier than when they
rted.

LE OF GAS

These factors led two dental surgeons
med Cherry and Pallin to, in 1947,
ise a unique method which they called
"ychological assurance, simple abstrac-
n (not extraction), and music".

The usual method of administering gas
from a machine which has a nitrous
cide cylinder and an oxygen cylinder.
e two gases are mixed through valves
d led through rubber tubes to a mask
vering the nose.

Cherry and Pallin built a simple auxi-
ry apparatus in the form of an ordi-
ry record player from which music
s transmitted to the patient's ears
rough a stethoscope arrangement of
bber tubes terminating in large rubber
ps which fitted over the patient's ears.
ese excluded unwanted sounds whilst
e patient listened to the music. There
also a microphone attachment so that
e operator can talk to the patient if
cessary.

Having been kidded into the chair the
erator talks about the music and shows
e patient how to operate the volume
ntrol.

At first it was found that some patients
rned the volume up too high and either
ept himself awake or woke himself up.
his is now overcome by having an ad-
itional control so that the operator can
ontrol the volume also.

USIC AND DENTISTRY

The music is started and the mask put
ver the nose. The gas is turned on and
ed to the patient in a concentration of
bout 75% nitrous oxide and 25% oxy-
en. The oxygen content is further in-
reased after the patient is asleep, and
an be as much as 50%.

This dilution has never before been
ossible and the results show that, not
premedication not required, but
he patient "woke up" without the usual
fter effects. There was no variation
pulse rate or blood pressure rate.
There was no delirium with the patient
struggling or saying silly things or laugh-
ng idiotically, no vomiting. The patient
emerges from the anaesthetic rapidly and does not require assistance from the chair.

Most patients claim that they dream! pleasant dreams whilst under the influence and even children were induced to undergo the operation without the usual tomfoolery and little white lies.

The most effective music was found to be a pleasant flowing rhythm with even tones without any sudden change of volume. Clair de Lune (Debussy), Beethoven's Moonlight Sonata, Wagner's Forest Murmurs, are among the records used.

It was found that with the aid of music the patient went into the most deep coma. The breathing very often kept pace with the rhythm of the music, proving that, although unconscious, the patient could hear it and be influenced by it.

THE WALTERS METHOD!

One can imagine all sorts of possibilities with this method, such as playing Rock 'n' Roll to a susceptible patient and having him jump up and down in the chair. Get a grip on the tooth, turn on the music. Turn off the music, get a grip on another tooth, turn on the music, and so on to the end of the jaw bones. Or you could prepare the patient for false teeth with such music as "All I want for Christmas is my two front teeth". Or the patient could be "conditioned" for a post operative painless "extraction" by playing such numbers as Money, Money, Money, or Pennies From Heaven. Or should it be "Guineas From Heaven"?

MUSIC IN INDUSTRY

Music in industry or music while you work is quite an established thing.

This was not instituted merely for the entertainment of the patients in factories. I beg your pardon, I should have said workers. There are similarities which amount to much the same thing anyway for boredom and fatigue can almost turn people into "cases" and sometimes they appear as under an anaesthetic.

Now if boredom and fatigue can be reduced then the worker works harder for his money and if this can be done painlessly while you entertain him at as little cost as possible then he is happy at his job, he makes more things, the firm makes more money, the shareholders get higher dividends, Mr. Fadden gets more tax and everybody, therefore, is happy while the worker gets the same "screw" as before unless he is on piece work. And all because you played a record.

Boredom is more intense about the the middle of the day or other working period. This decreases toward knock off time, which is natural because then a pleasurable anticipation intrudes itself.

Where there are no diversions workers try to counter this boredom by singing, talking, making excuses to leave the room and so on.

Now it is not possible to have bands of minstrels or circus elephants or clowns or comedians running around the factories. Television or anything requiring watching is impossfble. So music was tried.

EFFECT ON OUTPUT

It was immediately found that the increase in output was between 6 and 11 pc. with the average daily output being around from 3 to 6 pc.

Scientific tests have been carried out with instruments.

One instrument is the dynamometer. This is one which the subjects grip and the pressure is measured. His pressure was measured before music started and while music was playing. It was found that stirring music caused the worker to exert greater pressure and depressing music less pressure.

The aiming test determined how music affected precision and accuracy. This

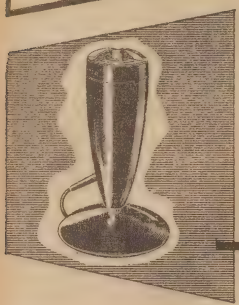
(Continued on Page 121)

acos

A COMPLETE RANGE

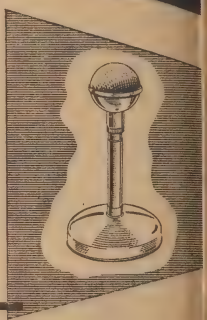
CRYSTAL MICROPHONES
MICROPHONE INSERTS

FOR EVERY PURPOSE



DESK or HAND MICROPHONE, MIC36

This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost. **PRICE, £6/18/6.**



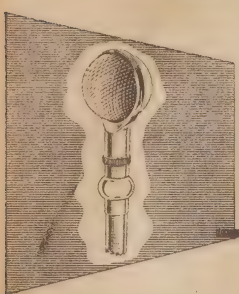
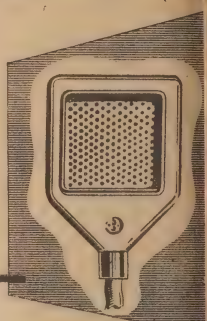


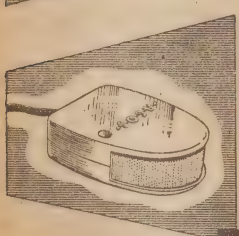
TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**



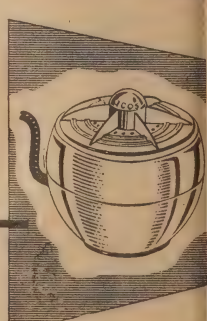
HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



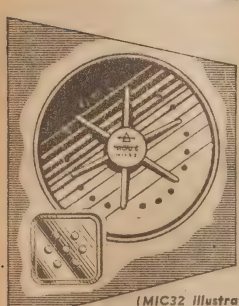
LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6.**



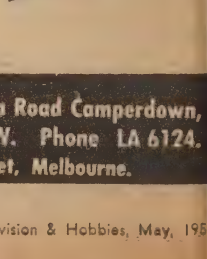
GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substanially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**



HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



CRYSTAL MICROPHONE INSERTS

These inserts are available in varying sizes, ranging from as small as $\frac{1}{8}$ in. square to 1-$\frac{1}{8}$ in. round, with various thicknesses from $\frac{1}{32}$ in. to $\frac{5}{16}$ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur transmitters, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC19/4 and MIC32, **£2/15/6**; all others, **£1/19/6.**

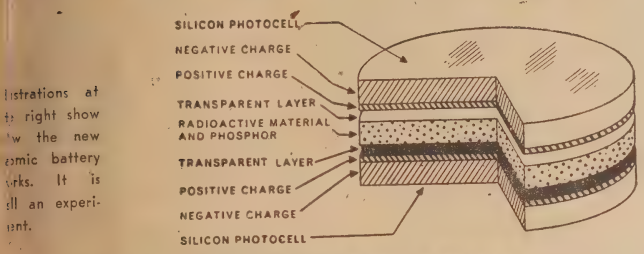
(MIC32 illustrated)
(MIC23 illustrated)

Sole Australian Agents:

AMPLION (A'sia) PTY. LTD. 88 Parramatta Road Camperdown, Sydney, N.S.W. Phone LA 6124.

Victorian Distributors: DISTRIBUTORS CORPORATION, 403 Bourke Street, Melbourne.

Technical Review



...istrations at ...t right show ...w the new ...omic battery ...rks. It is ...ll an experi- ...ent.

BATTERY USES ATOMIC POWER

Atomic power seems a "natural" for big things. Atomic power stations, submarines, locomotives — all large, solid structures producing great amounts of heat and power.

BUT engineers and physicists are turning their efforts in other directions, for only when we can extract nuclear power for any use, including the humblest tasks, can the atomic age be said to have arrived.

Atomic power may some day operate your wrist-watch.

This atomic battery, less than ½-inch thick and about a ½-inch in diameter, was produced by the joint efforts of Elgin Watch Co and Walter Kidde Nuclear Laboratories with such an ultimate objective in mind

Using plutonium 147 as its power source, it is still far too expensive to be practical. But the Atomic Energy Commission believes the element will soon be available in large enough quantities to bring its price down to 50c a curie or so. (Plutonium 147 costs about 500 dollars a curie now.)

The atomic battery is a complex device, in which energy is first turned to light, then back again to energy.

The plutonium 147 is the layer in the middle of the layer-cakelike assembly. Mixed with it are phosphors which give out light as they are bombarded by beta rays from the plutonium. The light rays are converted into electricity by the silicon photocells which form the outside layers of the battery.

Present experimental models produce as much as 20 ua at 0.25 volts. Voltage may be doubled by connecting the photocells in series instead of parallel, and quadrupled by sawing each photo cell disc into two semi-discs and connecting them all in series.

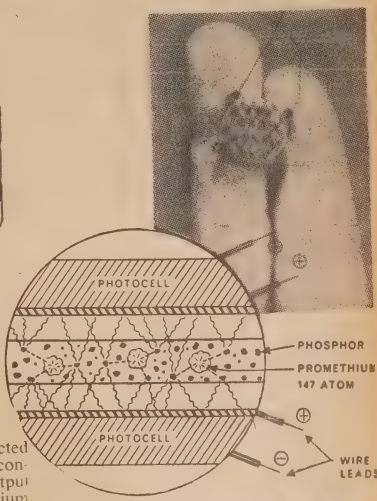
Higher currents can be produced with larger cells and probably also by improvements due to research now under way.

The useful life of the cell is expected to be a little over two years of continuous duty, at which time its output will be halved, the half-life of plutonium being 2½ years.

The atomic battery can operate at full current output without shortening its life

With its metal shield, the battery radiates less than a radium-dial wrist-watch and will be entirely safe for such personal uses as watches and hearing aids

—Radio Electronics.



A NYLON WAREHOUSE

A PORTABLE warehouse which can hold 2-million pounds of package goods and yet fold into a 5-foot long package, was displayed recently in Chicago.

When inflated, the building is 80 feet long, 40 feet wide, and 20 feet high. It is made of a thin, tough, vinyl coated nylon fabric known as Fiberthin. It can be erected by three men in an hour and costs about 2000 dollars.

Steps in erecting the warehouse are as follows:

The material is spread out flat on the ground. Air is forced into the structure under low pressure from a compressor. This results in the material bulging upward and outward. The air pressure keeps the walls and roof taut.

Around the base is a tube 15 inches in diameter which is filled with 23,000 pounds of water. This anchors the structure to the ground.

Printed Circuit Aerials

As illustrated below, printed circuits are now appearing in antennas. The pair of wavy lines seen through the plastic of this back-of-set antenna — and more clearly on the detached piece alongside — is actually a shorted stub, which is switched across or in series with the rabbit-ear type of antenna in various combinations, to match local reception, interference and ghosting conditions.

The printed circuit aerial.

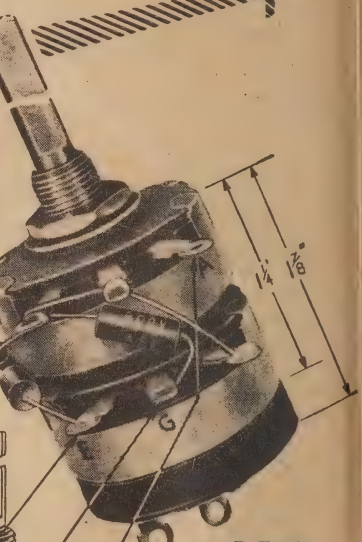
IRC AUSTRALIA

LOUDNESS CONTROL

has been designed to replace your existing volume control

and to provide correct high and low frequency compensation as volume is reduced . . . thus maintaining the correct tonal quality right down to whisper level.

(Patent Applied for No. N11262)

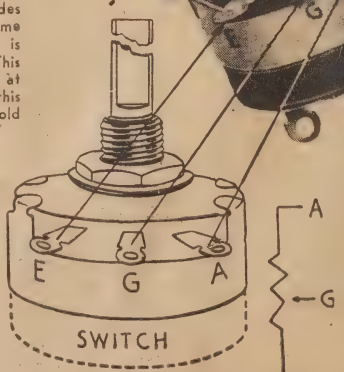


The IRC Loudness Control is designed to replace your existing Volume Control and provides correct high and low frequency compensation as volume is reduced . . . and maintains the correct tonal quality right down to whispe- level.

For many years there has been a need for a volume control in audio systems which would automatically keep the proper balance of all frequencies within the audio range at any listening level. I.R.C. has developed such a control, known as the LBI, to meet this need.

With the loudness control it is possible to reduce the output volume of any good or average system to a whisper and still be able to hear every tone with perfect balance, as the LBI provides gradually increasing high and low frequency boost as the volume is reduced to offset the deficiencies of the human ear which is insensitive to high and low frequencies at low volume. This accounts for the reason why many audio systems are operated at such high levels to give the best listening effect and in this process they become annoying to other members of the household and neighbours.

The I.R.C. new loudness control consists of two separate volume controls operated from a single shaft of standard size and used with a combination of capacitors and resistors which are already wired. The unit will replace any volume control by transposing 3 simple connections, as indicated by the illustration at right. Can be fitted without experience.



PRESENT VOLUME CONTROL

LB1

NOTE:
The automatic compensation of the LBI eliminates the necessity for a tone control.

AVAILABLE in 1 meg. 500,000 ohm with or without switch. Other values to special order.

PRICES
With D.P.S.T. Switch 32/6; Without Switch 26/6.
Available only from your usual supplier

Post this coupon today!

Please forward Loudness Control pamphlet giving detailed description and installation instructions.

*NAME*_____

*ADDRESS*_____

*SUPPLIER (optional)*_____ May

Sole Australian Agents:

Wm. J. McLellan & Co. Pty. Ltd.

126 SUSSEX STREET, SYDNEY · BX 1131

(50 yards from King St.)

WIRELESS FM CROPHONE

. major production run on a ew wireless microphone system as recently been completed by tephens Tru-Sonic Inc., Culver ity, California. The system omprises a miniature FM ransmitter, which is highly ortable, along with a special M receiver, power packs, and monitoring amplifier.

he unit is designed for high-fidelity rd pickup on the stage, in night- s, radio and television, motion pic- , industrial, and law-enforcement ap- lations.

he transmitter is slightly smaller than ackage of cigarettes, weighs about 4 ces. and is easily concealed either on 's person or in a room or stage set- i .

Designed to be used independently, hough a public address system, or for ording, the unique system has numer- o uses where a good-qualify sound p up is required.

he transmitter radiates about 20 mw. o FM signal on an assigned frequency o 42.98 mc. A small pressure-sensitive acitor microphone built into the trans- tter forms part of the Hartley oscil- lor

Variations in sound pressure thus pro- ce changes in oscillator frequency at ate equal to that of the frequency of t sound source. This oscillator is capa- ively coupled to a doubler which oper- s at the second harmonic of the oscil- lor frequency.

Deviation produced in the oscillator i thus multiplied by a factor of 2. A uarter-wave antenna (a fine, flesh- olored wire permanently connected to e transmitter) is conductively coupled the proper point on the tank circuit the doubler, while the transmitter ttery cable and battery act as the ound plane for the antenna system.

The separate receiver uses its own tenna, which may be connected to its ounded-grid input stage via a 50-foot ax cable.

The receiver is a complete superhet lacking only the audio power output stage. A conventional Armstrong discriminator is used along with two limiters. An afc circuit is included to prevent loss of tuning along with an audio squelch circuit to eliminate objectionable noise when the transmitter carrier is not on.

Metering facilities are provided to measure incoming carried strength and proper tuning. The output of the discriminator is fed to a cathode-follower stage, whose output is transformer coupled. The transformer provides a completely isolated output and its leads may be strapped for any conventional transmission line impedance.

The transmitter power supply is a battery pack for portability. The receiver, however, is powered by an ac power unit that not only supplies operating voltages but also provides audio amplification for a built-in monitor loudspeaker.

Two models of the complete system are available. One has a range of about 1500 feet, with a useful transmitter battery life of two hours continuous (employing the 10-ounce personal battery pack).

A larger battery supply is available whose life is 20 hours continuous. The second system has a 500-foot range and a battery life of six hours with the small pack. This latter system uses two CK-5672's in the transmitter. The price of the longer range unit is 1060 dollars complete, while the other unit sells for 980 dollars.

CCORDING to recent medical re- ports, people may some day get placement parts for their bodies al- ost as easily as they can now buy car eplacements.

Ears have been made from rib carti- ge, using a mould which is placed in e patient's body until the necessary rowth has taken place.

Rib bones have also been used to atch skulls.

Skin grafts in the future may be prayed on by first dividing them into iny fragments suspended in a salt solu- ion which will be sprayed on a fine- nesh gauze over the graft area. By he third week, tiny islands of skin will ave grown to completely cover the rea.

It has even been suggested that new earts and other organs may be grafted nto place. This technique has already een successful with animals.

IN 15 to 30 minutes. water contaminated by an atom-bomb explosion or atomic-waste accidents can be decontaminated and made safe for emergency drinking use.

Tiny grey beads called ion-exchange resins are used and the process is similar to the one that goes on in home water softeners. Radioactive ions (electrified particles) in the contaminated water are "traded in" or deposited upon the resin beads so that the water drawn off is safe for use.

The method would be effective, small-scale experiments show, if the contamination is not more than ten times the maximum safe amount.

NEW RADARS SPEED UP TRAFFIC

Long-range radars that can track aircraft from 130 to 200 miles, depending upon size and altitude, will be turned over to CAA by Raytheon beginning next summer. Map can be projected on screen electronically for quick identification.

In its biggest single electronics purchase, the USA Civil Aeronautics Association has ordered 23 long range radar ets as part of a nation-wide scheme to improve air safety. Each has a range of up to 200 miles and up to 70,000 ft of height.

Features of the 23 long-range radars to be used at strategic airports throughout the country include linear or circular polarisation and moving target indication. Linearly polarised waves are reflected uniformly by the desired target and by storm clouds and are therefore useful in spotting storms.

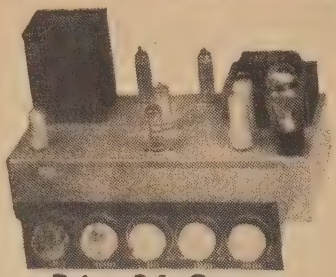
When the waves are circularly polarised, the millions of spherical raindrops reflect them in reverse and the return is filtered out. However, aircraft tend to reflect a large portion of the wave with the original twist and can therefore be spotted through storm clouds.

Moving target indication circuits built into the radar equipment discriminate between fixed obstacles, such as buildings and mountains, and show only moving objects.

Trouble circuits show continuously the operational state of the equipment and allow operators to switch to alternate channels while maintenance is carried on.

Each radar employs a 40ft antenna that effectively covers about 125,000 square miles of area.

HI-FI AMPLIFIERS AND TUNERS



Price 36 Gns.

Preamp only £16

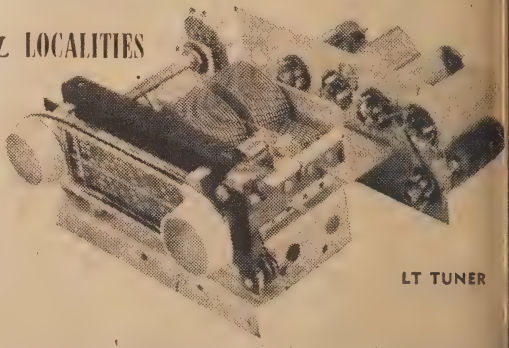
BASIC MULLARD 5-10 AMPLIFIER WITH PREAMPLIFIER

Output: 10-13 watts
Response: 10 Cycles to 20Kcs flat
Sensitivity: 40mV
Bass Control: +15 to -12 db
Treble Control: +15 to -20 db
Distortion: .1% or better

STANDARD MULLARD 5-10 (SINGLE CHASSIS) UNIT £26/15/-

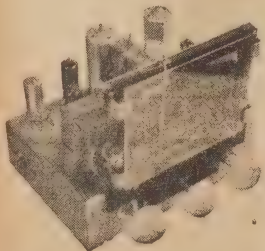
TUNERS FOR *ALL* AMPLIFIERS AND *ALL* LOCALITIES

- LT1. 6AN7 converter 6BH5 IFA 12AU7 detector and LoZ output. 10 kc whistle filter. Broad/Sharp IF switch **£15/15/-**
- LT2. As LT1 but with aerial band pass **£17/2/6**
- LT3. 6BH5 RF amplifier 6AN7 converter 6BH5 IFA, 6N8 detector and audio. Has its own volume control. Intended for low signal areas **£21/17/6**

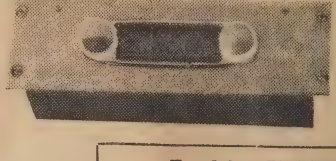


LT TUNER

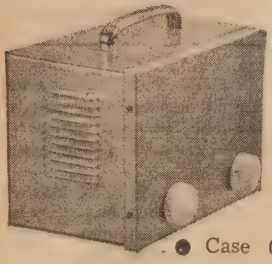
PLAYMASTER No. 3. As in R. TV & H. MAY '56 6AE8 converter 6N8 IFA and det. Broad/Sharp IF switch **£13/13/-**



- PLI As Playmaster Tuner No. 2 (July '53). but with 6BH5 IFA and incorporating its own power supply and volume control **£28/12/6**



P.M. No. 3



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- With EF86 Mic preamp. £22/15/-
- Case (as illustrated) 27/6 extra

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- 2 Germanium Diodes
- Completely aligned
- Suit NSW, Vic & SA.

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LM1554 **MIRROFONE ELECTRONICS** LM1554

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RADIO REPLACES SEMAPHORES ON GERMAN RAILWAYS

Motorman of passenger car has telephone (at right hand) and illuminated signal box (above his head). Signals from passing train actuate lamps at central control board (right) that shows track occupancy and progress of trains.

Railway signalling systems have depended on mechanical means aided by various electrical methods. Of recent years, a number of ideas have been worked out to improve the warning efficiency of signalling, and to overcome some of the disadvantages of commonly-used methods.

Railway trains on the 41 km line between Malsfeld and Treysa, Hesse, Germany, are now controlled by signals in the cab received by radio. Although the system is essentially for signalling, voice communications are also possible when desired.

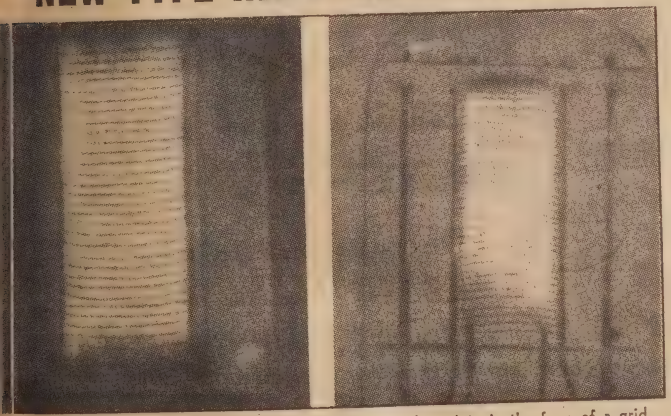
Orders from the switching centre at Homburg are relayed to stations along the line and when confirmation is received the centrally operated signal system is appropriately set.

Rail magnets at numerous points along the route automatically indicate the position of the train at the central switchboard by means of lamps on a miniature route board.

Colored lights in the cab show orders for stop, go and slow. Warning signals show that a change will take place and a horn gives audible indication of a change in signals.

It is hoped by the use of radio to eliminate errors through faulty and bad visibility, always a hazard particularly in bad weather. Enormous savings seem possible by eliminating installation and servicing of control lines.

NEW TYPE HEATERLESS VALVES



Self-sustained secondary emission developmental tube has plate in the form of a grid. Two different cathodes show effects of surface material on emission pattern.

Cold cathode self-sustained field emission tubes, called sse tubes, are presently under development at the laboratories of Tung-Sol Electric Inc., Bloomfield, New Jersey. These tubes are characterised by their ability to provide plate currents of 25 to 50 ma per sq cm of cathode surface at plate voltages ranging between 100 and 300 as differentiated from tubes requiring either gas or high plate voltage to obtain current.

Main emphasis is being placed on determining the structure of the cathode coating. The coatings, usually some form of magnesium oxide, may be applied to the cathode base by either spray or cataphoretic techniques. For the moment, porous surfaces seem to give a more uniform distribution of current over the total surface.

Starting the emission presents a problem. A Tesla coil is now used, although ultraviolet light and radioactive materials could also be employed. One direction of present research is to determine ways of establishing easy starting conditions.

Emission in these tubes is always combined with electroluminescent effects that give the cathode a blue light. So far high local or spot temperatures ranging from 30,000 to 150,000 C and wide velocity distribution are the main deterrents to their application in devices.

As seen in the photographs, the emission patterns are spotty, originating from the cracks in the coating, which seem more active. As emission becomes more uniform, it is expected that higher transconductance values for control grid structures will result, making them feasible as replacements for some present tube types.—Electronics.

RUBBER PROTECTS SNARK

USING a silicone rubber that cures at room temperature, engineers at Northrop Aircraft, Inc., have developed a quick, easy and almost foolproof guarantee of top performance for vital electronic circuits in the Snark guided missile, the F-89 jet and other projects.

Electronic circuits and other gear designed to record or transmit information during flight are coated with Silastic RTV, the room temperature curing silicone rubber. According to Northrop designers a single coating of the silicone rubber will cushion vibration at low temperature, provide maximum moisture resistance, improve all the electrical properties, and protect the assemblies from rough handling.

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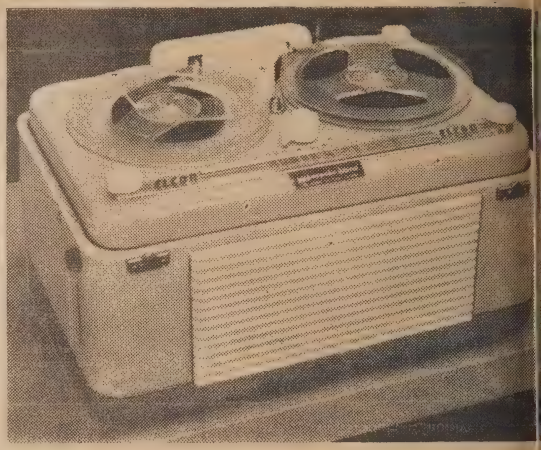

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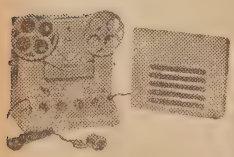

MICROPHONES:

Zephyr mikes from £2/13/11. Philips microphones priced from £3/5/-. TAPES: Agfa tape, 600ft, of 5in, 30/-; 7in, 54/6. 1200ft, plastice reel, £2/14/6 E.M.I. tape, £2/18/-. Special high fidelity tape, 1200ft, just £3/5/-. B.A.S.F. tape, 600ft., 39/6; 1200ft, at £3/5/-; 1850ft, long-playing, £3/18/-. Empty reels, 5/-, 7/6, 10/-.

RECONDITIONED BARGAINS

A.W.A., bargain at .. £75
Tecnicorda, only £95
Grundig, as new £85
Elcon, good order £65

NEW 'ELCON' HERE

Records up to 3 hours £124

Model TR6. One-knob control rewinds and plays back, gives up to HOURS' recording, inter-changes tape with almost any other tape r corder. Two speeds, gives wonderful quality reproduction of music a speech. Built-in Public Address system. Complete with tape and micr phone.

7-Valve De Luxe Radiocorder £155

ELCON Model TR6R (Deposit £25) is the same new design with 7-valv radio and tape recorder combined. Microphone pickup.

New A.W.A. Magictape £135'8'4

Complete with microphone and tape. Brand new twin track mod Gives 2 hours' recording. Complete with two-tone carrying cas Complete with tape indicator.

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Latest model UG666. Beautifully compact, 2 speeds, 3 motors, the be buy in home recorders. 12 months' guarantee.

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(2 doors from Kodak), BX 4440, BX 4587

NEWS AND VIEWS OF THE MONTH

The BBC and color

A touch of color—in the literal sense of the word—brightened the sombre dignity of the Palace of Westminster recently when, at the request of the Postmaster General, the BBC gave members of both Houses of Parliament an opportunity of seeing its current series of color television transmissions.

The BBC installed both color and monochrome television receivers in a committee room in the House of Lords and more than 200 members from both Houses packed the room to watch the half-hour variety show to be televised in color in Britain.

They saw the BBC's "signature picture" of the Palace of Westminster in clear color, as announcer Sylvia Peters introduced a program which included a calypso team, Cy Grant, the West Indian humorist, singing a special calypso about the miracle of color television, and a natural history demonstration.

COMPATABILITY

The monochrome receivers enabled members to judge the quality of the pictures that people without color receivers would get from the same transmission, which is to say, the "compatability" of the system. The artists performed in the BBC's color television studio at Alexandra Palace in North London and the program was transmitted from the BBC's high-power television station at Crystal Palace in South London.

The Postmaster General's Television Advisory Committee has been asked to report on the whole field of color television, and the BBC has been studying for some years the technical problems that have to be solved before a decision about a public service can be given.

As part of this study and in agreement with the committee, the BBC undertook in 1955 to demonstrate the results of its work by broadcasting experimental television transmissions in color.

NEW TRANSMISSIONS

The first series of transmissions started in October, 1955, a second series began in April, 1956, and the present series, which will continue for some months, started in November 5, 1956. About 3 experimental color receivers, some built by leading radio manufacturers and some by the BBC, are in use by the BBC. In addition, about a dozen manufacturers have developed receivers for these tests, which are transmitted after normal program hours and can be seen by members of the public in the London area on their sets at home, in black and white.

Both the Postmaster General, Mr. Ernest Marples, and the Director-General of the BBC, Sir Ian Jacob, stressed that the demonstration at Westminster was only a "progress report" on one system, and that in view of the many problems remaining to be tackled, color television as a regular service in Britain was still two to three years away.

★ ★ ★

Radioactive food

THE Federal Food and Drug Administration has asked US housewives whether they have any tinned food bought before 1945.

The agency said that it was starting a survey to see if atomic tests and other uses of atomic energy changed the radioactivity of food.

The first step was to get food tinned before 1945—when the first atomic explosion occurred—to establish a base for radiation measurements.

★ ★ ★

Scatter TV

A POWERFUL antenna which relays TV images by bouncing them off a six-mile high layer of atmosphere, has brought the world to the threshold of intercontinental television.

The antenna, which can transmit clear images hundreds of miles, was developed for the US-Canadian radar warning system.

Ira Kamen, research chief for the company which developed the antenna,

said it works on the "scatter propagation" method.

It shoots an image toward the horizon, where it hits the troposphere—a six-mile high layer of the atmosphere—and is then bent back toward the earth.

The image is then picked up by another antenna, which relays it on.

By building antennas across the Atlantic, it would be possible to bounce television images to Britain, he said.

★ ★ ★

Germany goes automatic

WEST German industry in the next few years will turn increasingly to automation, economic experts say.

One compelling reason for this, they explain, is the increasing scarcity and cost of labor.

Industrialists believe, too, that automation will help to ensure that economic expansion, which has shown signs of levelling off lately, continues and that West Germany will remain competitive in the export field.

Hardly a day passes without public discussion at meetings or in the Press of the best way for West Germany to develop automation.

Both employers and workers favor its introduction.

★ ★ ★

Satellite tracking

THE US Navy will have equipment on three continents to track a planned earth satellite.

The satellite will be launched during the International Geophysical Year, which begins on July 1.

The tracking equipment will be sent to points in US, the British West Indies, South America and Australia by July 1.

The navy also announced that 24 navy and army engineers and technicians are being trained to use "mini-track" radio stations in tracing the satellite's path.

★ ★ ★

Mind the cylinder

CLAIMED to be the biggest cylinder ever carried by truck in Europe, one measuring 33yd long is travelling slowly at the rate of 2¼ miles an hour from Paris to the Marcoule atomic energy station. The distance to be covered is some 300 miles and already three houses have had to be knocked down in one village to enable it to pass, and at another point 200yd of new road has had to be made.

The monster cylinder on its 116-wheel truck is proving such a hindrance to motorists that "Le Figaro" is printing a daily map showing where it is and the route it is following.

★ ★ ★

Bridge with dimension

AT Tancarville, near Le Havre, the French are building Europe's biggest suspension bridge over the Seine estuary.

The Tancarville bridge will have three suspended spans supporting a continuous, metallic roadbed 3152ft long between two anchorage blocks. Total length, with the left-bank approach, will be 4593ft. The Seine, 2000ft wide at that point will flow beneath the central span with a clearance of 160ft from the water's surface.

Some 2-million cubic feet of concrete will be used in the structure, including over 700,000 cubic feet for the two anchorage blocks and nearly 900,000 cubic feet for the superstructure and the tower foundations.

About 15,000 tons of steel will be used, including 3210 tons for supporting cables and vertical sling cables between the supporting cables and the roadway.

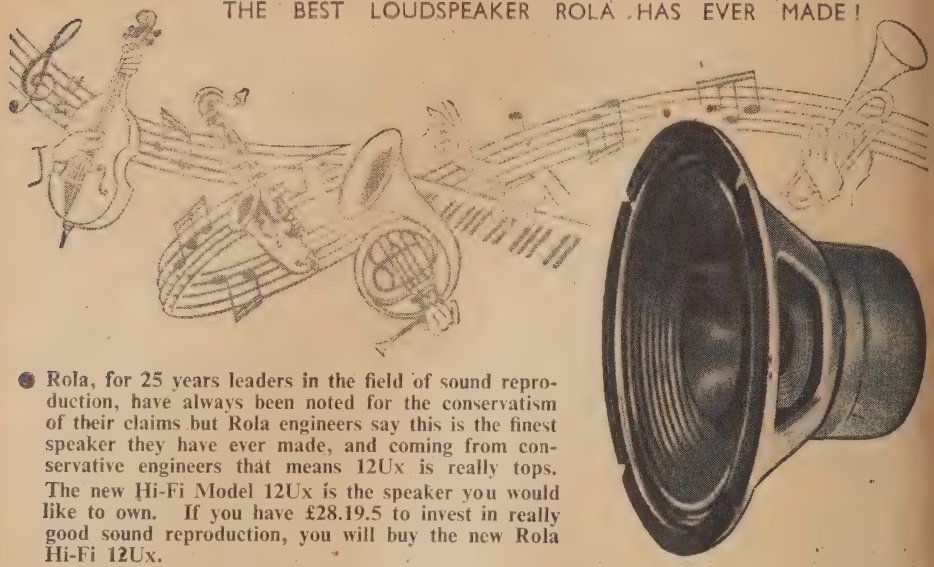
These two supporting cables, suspended from the four 426ft high reinforced concrete towers, will each be 0.6 mile long, and made of 56 elementary cables. Between the two anchorage blocks the cables will be continuous, with four additional cables for the two side spans.

Each of the 56 elementary cables will be 7 centimetres in diameter, comprising 169 strands. An over-all total of 14,000 miles of solid steel wire will be used.

The enormous anchorage blocks are to be built of prestressed concrete, the world-famed French technical achievement.

and NOW! *the* Hi-Fi ROLA 12-Ux

THE BEST LOUDSPEAKER ROLA HAS EVER MADE!



● Rola, for 25 years leaders in the field of sound reproduction, have always been noted for the conservatism of their claims but Rola engineers say this is the finest speaker they have ever made, and coming from conservative engineers that means 12Ux is really tops. The new Hi-Fi Model 12Ux is the speaker you would like to own. If you have £28.19.5 to invest in really good sound reproduction, you will buy the new Rola Hi-Fi 12Ux.

Its brilliant transient response will bring to your living room every delicate nuance of the original sound—the booming of the tympanis, the realism of clashing cymbals, the tinkling of the triangle.

● If you are interested in technicalities, here are the details:

Frequency response	40-14,000 c.p.s. flat ± 6 dB
(Usable response to 30 c.p.s. in the Rola recommended vented enclosure).	
Power handling capacity	20 watts
Intermodulation distortion : (F1/F2 ; 45/7,000 c.p.s. ; Ratio 1 : 1)	Less than 2% at 20 watts output
Voice coil impedance	15 ohms at 400 c.p.s.

● *But it is your Ear that is the Final Judge*

Hear the Hi-Fi 12Ux and you will agree with us that Rola has produced Australia's finest loudspeaker—a speaker which will more than hold its own in world competition.

ROLA COMPANY (AUST.) PTY. LTD.

unbathing and cancer

HERE is strong evidence that melanoma, a cancerous growth in pigmented moles, is caused by exposure sunlight.

A recent survey conducted in four stralian capital cities, under a grant the NSW Cancer Council, has shown s.

Results of the survey, carried out by H. O. Lancaster and Dr. Janet Nelare published in the Medical Journal Australia.

Last year Dr. Lancaster published a vey showing that skin cancers had a gher incidence in Queensland and more pical climates than in colder parts of stralia.

In the present survey, a high perntage of people with fair or red ir, fair skin and blue or green-grey es were represented among melanoma tients.

The research team found that 62 pc patients burned easily in the sun, id did not tan.

Almost 30 pc gave a history of sunthing, and 26.6 pc had had excessive posure to the sun, in the opinion of e doctors.

★ ★ ★

ockets probe weather

HE US Army is firing rockets from deep in northern Canada to measure y winds 80 miles up.

The experiments are expected to lead more accurate predictions of cold eather during winter months.

The army said the first specially-quipped rocket was fired last November at Fort Churchill, Manitoba.

The rocket sprayed 18 packets of igh explosives into the air at pre-set ntervals during its ascent.

When the 4lb charges exploded, sensitive instruments on the ground recorded the barely-audible blasts.

Scientists measured the time lag between each explosion and the arrival of he sound at the earth.

From this data they computed important facts about the direction, speed nd temperature of polar winds.

The army said the Fort Churchill tests were part of a world-wide check of high altitude currents which spawn weather.

Extensive observations of western air currents already have been made at White Sands, New Mexico, and another series of launchings was planned at Guam in the western Pacific.

★ ★ ★

British defence plans

THE British Government warns that there is no means of protecting the public adequately from H-bomb attacks.

Development of the hydrogen bomb and rocket weapons with nuclear warheads has altered the whole basis of military planning.

Presenting an annual defence report claimed to involve "the biggest change in military policy ever made in normal times," the Government said:

Basic concept of Britain's new defence pattern is to cut costs through less manpower on the ground but to achieve greater efficiency through nuclear and rocket weapons, and priority for atom-bombers and guided missiles.

The Government intends to supplement Britain's now "substantial stock", and "steady production" of atom-bombs by ballistic rockets.

THIS BABY CAR HAS A BIG FUTURE

A British made Isetta motor car, designed in Italy and so far made only in Germany was last month exhibited in London. This handy little runabout is popular on the Continent and in the USA.

POPULAR SCIENCE QUIZ

Q: How strong is a spider's web?

A: The strength of the thread which the spider spins varies with the type of spider, but it is one of the toughest in existence.

Its tensile strength is greater than that of steel, and second only to fused quartz.

A thread thick enough to be seen with the naked eye is usually a cable composed of several threads, each of which may be only one-millionth of an inch thick.

These are expelled through pairs of spinnarets—generally three in number—located near the end of the abdomen. In spinning, the tips of the spinnarets are brought together so that the streams of secretion unite into a single thread.

Q: How long do animals live?

A: If man used all the knowledge he has about himself, he could easily live to 100 years but rarely does.

A dog is full-grown at two years and should live to 12 years. The equivalent figures for a cat are one and a half and 10 years, and a horse 4 years and 25 years.

Q: How much blood circulates through the human body every minute?

A: In the average man's body, about five quarts of blood are pumped every minute by that amazing muscle we know as the heart.

It commences its Herculean task before we are born, and continues until the moment we die.

The blood leaves the heart through the arteries, and returns through a system of veins. The arteries themselves are more than mere pipes. They are living, pulsing, muscular tubes into which the heart pours blood in regular gushes.

The arteries, through their ability to relax and contract between beats, even out this spasmodic flow into a steady stream, and carry it to the farthest point of the circulatory system.

The total length of blood vessels is astonishing. It has been estimated that the average man has up to 100,000 miles of them. They are completely automatic and self-repairing, the centre of a chemical system far more intricate than any yet devised by man.

Q: Is the hearing of animals keener than our own?

A: The answer to this question is yes and no. It is certain that most animals can hear sounds much higher in pitch than the average human being, although young children can frequently hear sound up to 20,000 cycles per second.

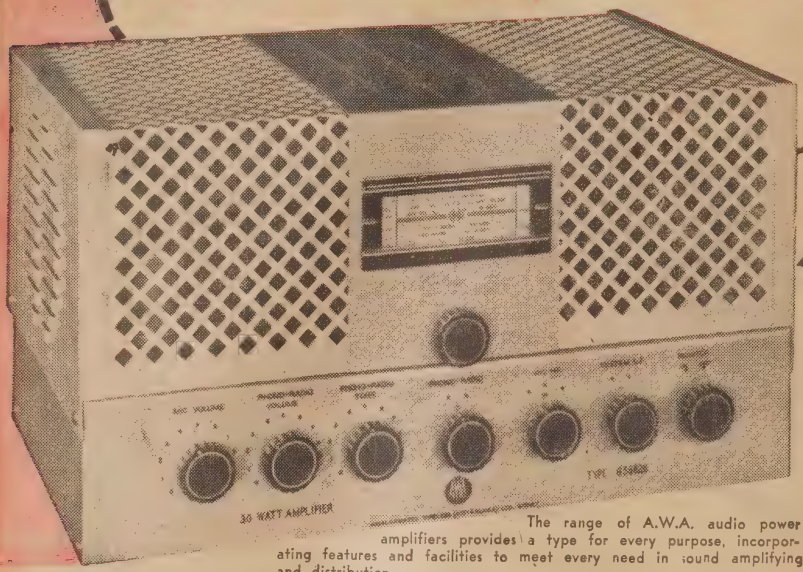
As they grow older, this upper limit declines, until at about 40 years old the average person cannot hear frequencies higher than about 12,000 cycles per second.

In old age this figure can easily fall to 6000 or 7000 and even lower.

Animals frequently use high-pitched sounds for communication. The classic example is the bat which emits squeaks higher than 50,000 cycles per second, and uses the reflections from these high-pitched notes to find its way about in the dark.

AWA PUBLIC ADDRESS AMPLIFIERS

5 watt to 70 watt

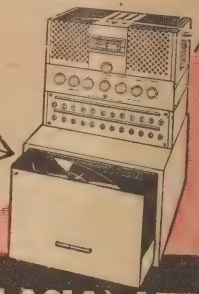


The range of A.W.A. audio power amplifiers provides a type for every purpose, incorporating features and facilities to meet every need in sound amplifying and distribution.

Designed and built to the same high standards of quality workmanship and performance for which the Company has established a world-wide reputation in broadcasting and communication equipment, models PA825 15 watt, PA826 30 watt and PA827 70 watt are illustrated above with radio tuner PA831 fitted. The amplifier protective cover has provision for mounting a monitor speaker.

5 watt portable amplifier type PA806 provides ample power for the needs of most indoor gatherings and many outdoor applications.

Radio, record playing, and speaker switching units assembled with the amplifier to form a centralised system.



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MATEURS--WAKE UP!

JRING Easter, the Wireless Institute of Australia will hold a Federal nvention in Melbourne, the home of Headquarters' Division, during which tters concerning Australian amateurs a whole will be discussed.

It is high time such a convention was d, as there has been no such gathering some years. Normally this is an an- al event.

Failure to hold these conventions has incided with a marked decline in the erest shown in Federal affairs.

OST-WAR PROGRESS

Immediately after the war, a deter- ned effort was made to obtain closer -operation between the Institute Divi- ons, one of which is centred in each ate, and one in New Guinea. After a riod of many discussions, conflicts, and althy vitality, a uniform set of articles as hammered out and accepted by them l. For the first time, Australian ama- urs had the machinery which would eld them into one body.

But of late years, this spirit seems to ve died. Divisions have once more come preoccupied with their own af- irs, and there is today every sign that, r lack of personal contact, they are rifting apart.

Unfortunately the worst example is und here in our own State of New outh Wales. This division, despite the ears that have passed without a Federal eeting, has decided that it will not send delegate to Melbourne.

RE THESE IMPORTANT?

In its last bulletin to members, com- enting on this decision, it asks whether ne Agenda items so far received are fficient justification for changing its ind.

Among the items are—

- Bringing the Federal Constitution up to date.
- Consideration of possible Federation of the Institute.
- Federal Council to be on a propor- tional basis (for voting).
- A common Civil Defence Plan for Australia.
- Sending a representative to the next ITU conference, which decides the fate of amateur frequency alloca- tions.

If these matters are not important nough for the NSW Division to be rep- esented—perhaps the largest in Austra- ia—what matters could be?

And how can any Federal Convention e truly representative, or produce posi- ive results, if it withholds its support?

It is high time this kind of thinking went into immediate and violent reverse if the amateur body as a whole is not to disintegrate.

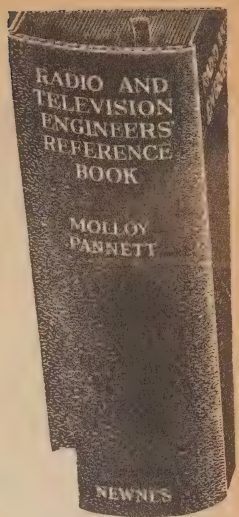
How can the Institute expect others to take it seriously, if, at this critical time in amateur affairs, it cannot achieve unity?

For only through unity will it build strength.

SOLVE THAT TECHNICAL PROBLEM

Have any of these books

Sent to you for 7 days' free inspection

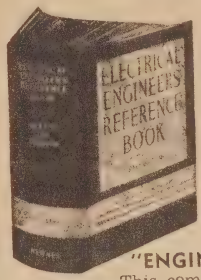


"RADIO AND TELEVISION ENGINEERS' REFERENCE BOOK"

"Radio and Hobbies" followers have found this book a "must". It is essential for those engaged in the design, maintenance, technical sales, operation and servicing of modern radio and television equipment.

Includes: Formulae, calculations, electron optics studio equipment, transmitter power plant, aerials, amateur radio equipment, wave-guides, V.H.F. transmitter-receiver equipment, commercial H-F links, navigation and radar, industrial TV, valves, tubes, transistors, diodes, interference, magnetic and disc recording, radio and TV installation and servicing, projection TV, units and symbols, etc., etc.

This list represents only a small fraction of the contents. £5/6/- subscription or £5/1/- cash.



"ELECTRICAL ENGINEERS' REFERENCE BOOK".. The 8th edition of this famous handbook, written by 71 experts.

This Standard Electrical work is yours for 7 days Free examination. Packed with practical knowledge and new developments. 32 sections: Calculations, Materials, Distribution, Motors, Wiring, Illumination, Heating, Welding, Refrigeration, Electronics, Electric Traction, Marine, Aero, Auto, etc. Covers entire field. 2184 pages, 281 photos, 2059 diagrams.

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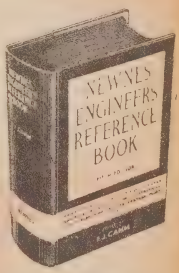

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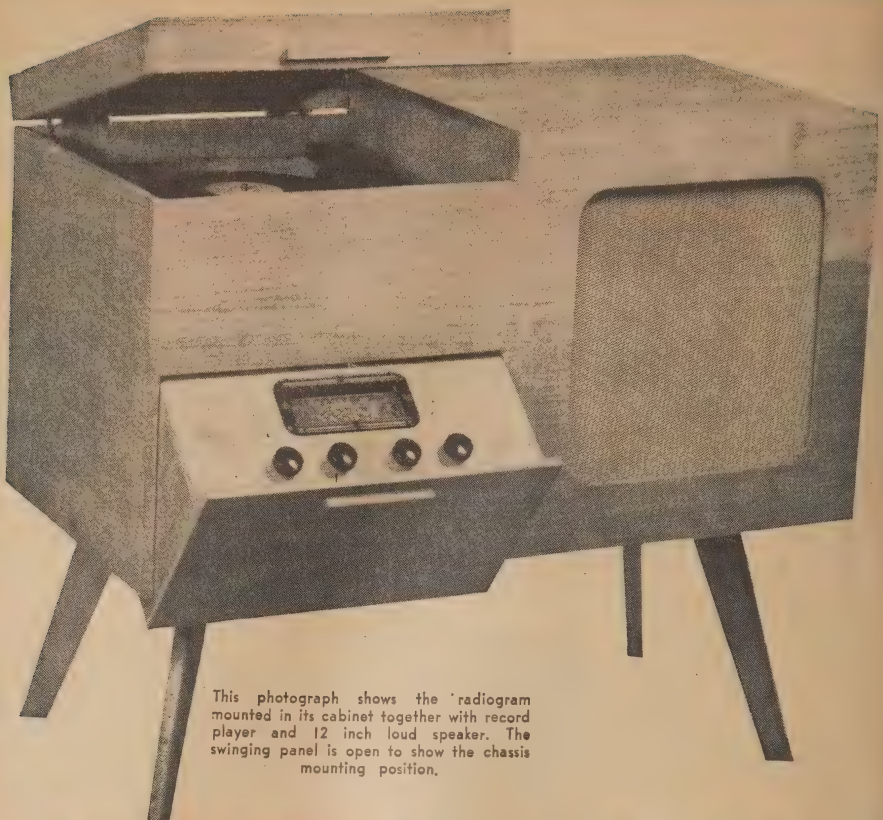


This photograph shows the radiogram mounted in its cabinet together with record player and 12 inch loud speaker. The swinging panel is open to show the chassis mounting position.

A New Standard Radiogram

This radiogram represents something new for us in the way of a constructional project. For the first time we have selected one of the most popular radio items at the present time—a standard radiogram—and worked it out from chassis to cabinet. And all of it is within the abilities of the average radio enthusiast and handyman.

by Wes Yashin

The popularity of the radiogram seems greater today than ever before. This is probably because the two most convenient sources of entertainment are the radio programs and gramophone records.

Even the introduction of TV has had little or no effect upon the sound entertainment field, because most people now realise that they are two different things.

TV programs are not very well suited to musical items. It is rarely good entertainment to watch people playing instruments, unless there is a dramatic element in the way of a specialty turn or something of that kind to keep up the visual interest.

One cannot imagine too many people watching the broadcast of a concert, or even popular music.

Nor do they wish to be occupied by looking at the screen, when mostly the sound they want is something to jig to or as a background to some other activity.

On the other hand, it is a logical step to combine the radio and the record player, for so much of the equipment is the same.

And it can be so conveniently housed in the one cabinet.

Up to date, we have assumed that radio constructors will make their own arrangement for housing the gear when they have built it, and of course they do this.

But the number of people who now make up their own simple furniture, not only to save money but to suit their idea of design, is very large.

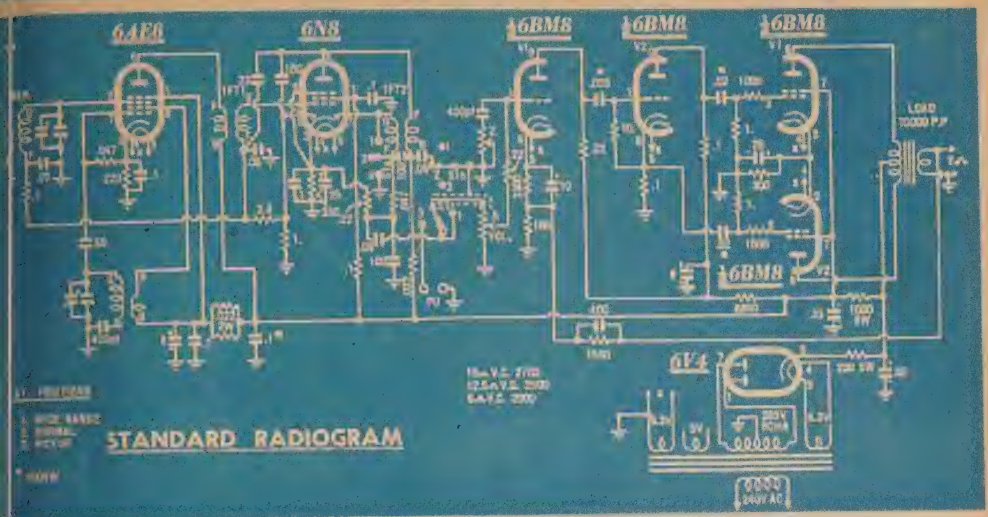
There are all kinds of simple woodworking tools available at low cost which remove most of the hard work and drudgery which used to be unavoidable.

And so we asked ourselves—why not work out a complete project in which not only the radio side was covered, but the woodworking as well?

In deciding on the final design we kept many things in mind.

Experienced woodworkers do not need elaborate plans to make up such a thing

CIRCUIT DIAGRAM GIVES MAXIMUM VALVE USE



...e circuit provides maximum performance from few valves including variable selectivity and push pull output. It is intended for operation with a standard crystal pickup.

...t radiogram cabinet. It is surprising ...w many people have a few power tools ...iked away in their workshops, capable ...naking all the standard types of joints, ... assisting them to produce really fine ...es of work.

It was obvious that anything we pro...ed should be capable of the utmost ...plification, so that even humble ...ipment could be used to make up a ... which, without being elaborate, ...uld be sturdy and of good appearance.

And at the same time, we wanted ...nething which would be more than just ...box on legs, or an extension of the ...e-old process of an upright piece of ...lished panelling with a cut-out for a ...il and loudspeaker.

HORIZONTAL STYLING

Looking around the radio shops to see ...at most people seem to like, we were ...pressed with the possibilities of a hori...ntal design with contemporary styling ... which the chassis was mounted on a ...inging panel.

This panel pulls forward to reveal the ...ning dial and other controls, and con...als all these when eased back into ...ace.

Alongside it is a speaker compart...ent large enough to take a 12-inch ...pe if desired.

Suitably proportioned, this type of ...binet lends itself to a wide variety of ...nishes, and because of its unobtrusive ...mplicity, can be made to fit in with the ...rnishings of almost any sitting-room.

By appropriate work on the drawing-...oard, it became obvious that, in its ...mplest form, the whole thing could be ...esolved into a number of pre-shaped ...anels which, when tacked and glued to...ether, would make up a cabinet with ...ttle more trouble than building a set of ...elves.

Even with the simplest type of assembly, the finished job to our eyes looked good, and as pointed out, is capable of extra elaboration by an experienced woodworking hobbyist.

The photograph at the head of this article will give you some idea of how successful the idea has been.

We took care to see that there is enough room to house not only all the standard record players of the medium quality type, but record changers as well.

It would be just as well to make a check on this point when buying a changer or player, but we think we have covered all those you are likely to buy. This process had a noticeable effect on the final cabinet proportions, as not only must there be enough room under the turntable lid, but the swinging panel must not foul the mechanism from beneath.

In settling on the design of the chassis itself, we kept the popular demand just as clearly in sight.

And at the same time, we think we

PARTS LIST

1 Chassis, 13 x 6 x 2¼ inches.
1 USL/47 Dial, (B'cast, AWA).
1 AWA miniature 2-gang.
1 Extension shaft for gang (⅛ x ⅜).
1 285/285, 80mA power transformer.
1 Output transformer, 10,000 ohms P:P (see text).
1 Miniature aerial coil.
1 Miniature oscillator coil.
2 455Kc IF transformers. (miniature).
1 Noval socket with shield.
4 Noval sockets.
1 3 x 3 switch. (Oak).
1 Miniature 4-pin plug and socket.

RESISTORS

1 10 meg ½ watt.
1 2.2 meg ½ watt.
3 1 meg ½ watt.
3 .22 meg ½ watt.
4 .1 meg ½ watt.
2 .047 meg ½ watt.
1 3,300 ohm 1 watt.
1 6,800 ohm ½ watt
3 1,000 ohm ½ watt.
1 330 ohm ½ watt.
1 220 ohm ½ watt.
1 100 ohm ½ watt.
2 .047 meg 1 watt.
1 .022 meg 1 watt.
1 300 ohm 3 watt.
1 1,000 ohm 5 watt.
1 200 ohm 5 watt.
1 .5 meg switch pot.
1 2 meg pot

CAPACITORS.

2 30 mfd 350 volt electrolytics.
1 8 mfd 350 volt electrolytic.
1 8 mfd 350 volt electrolytic (see text).
2 25 mfd 40 volt electrolytics.
1 10 mfd 40 volt electrolytic.
1 .1 mfd 400 volt paper.
4 .1 mfd 200 volt paper.
4 .05 mfd 200 volt paper.
2 .02 mfd 400 volt paper.
1 .005 mfd 400 volt paper.
1 425 pf mica (padder).
1 400 pf mica or ceramic.
3 100 pf mica or ceramic.
1 33 pf mica or ceramic.
1 47 pf mica or ceramic.
2 Trimmers.

VALVES.

1 6AE8, 1 6N8, 2 6BM8, 1 6V4.

SUNDRIES.

4 knobs, 4 terminals, 2 7-lug strips, 1 5-lug strip, 2 3-lug strips, nuts and bolts, solder lugs, solder, hookup wire, tinned copper wire, spaghetti, shielded wire, dial lamps, length of 3-core flex, length of 2-core flex, 1 3-pin power plug.

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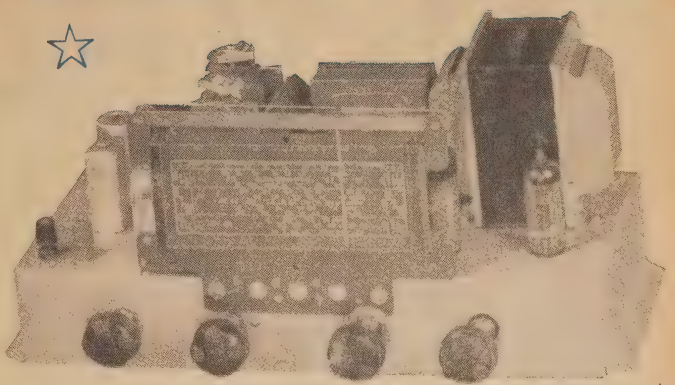
FRONT VIEW OF THE CHASSIS



This view shows the controls which are, L to R, Function Switch, Tuning, Tone control and Volume, On and Off Switch. The terminals are for Pick-up connection. Behind them is the tuning section of the chassis.

...e produced something containing a ...mber of features which, because of ...r combination in one circuit, will ...ble you to make up a job which can...t be duplicated by any commercial ...sign at the present time.

... has no frills, but it does not omit ...ything which is essential to a perform...ce only exceeded by a full Hi-Fi treat...nt.

...ot everybody requires Hi-Fi. Plenty ...people use their radiograms for play... popular music where the audience is ...t interested in playback curves, as long ...the sound is good and there is enough ...it.

...n fact, extreme wide range could ...ve embarrassing in such cases and ...ls for complex tone control and filter ...uits.

...Then, there are many readers who ...ve neither the means, nor the avail...e space, to install the multiple units ...a Hi-Fi system. Others do not need ...elaborate setup; their requirements ...ng quite modest.

...RCUIT DESIGN

...Facilities for playing either LP or ...ndard records at better than average ...ality and reasonable output, and the ...ility to bring in the local stations with ...se are their main interests.

...Our new radiogram meets these re...irements and, due to its simplicity, it ...ll allow one to stretch the budget when ...rchasing the necessary parts. Fre...ently, a set of this type has to be ...sembled with a very cautious eye on ...e cheque book.

...An inspection of the circuit will re...al that the set is nothing more than ...combination of the Playmaster Baby ...ner and the Low Cost Crystal Ampli...r. Owing to the popularity and sim...icity of both, we have combined them ...a circuit which could well set a stan...rd in low-cost radiogram design.

...The shape of the chassis and the lay...t of the components is largely gov...ned by the nature of the cabinet in ...hich the set is to be housed. Since ...is has always been a problem, left ...r the builder to solve, we set about to ...scover what could be accomplished in ...binet construction, using tools most ...kely to be found in the average work...op.

...We liked the result so much that we ...cided to devote an article to the con...ructional details of the cabinet in the ...ext issue.

...The design data for both the tuning ...nd the audio sections is essentially the ...me as that featured in the issues de...cribing these units.

...The tuner is a compromise between a ...ue wide range tuner requiring band ...ass circuits, and a standard superhet ...ner.

...It differs from the standard superhet ...ircuit in that it uses a scheme we pion...ered many years ago in an effort to ...mprove the IF bandwidth. This is re...erred to as variable selectivity, and is ...chieved by the use of a switching ar...angement to switch the second IF trans...ormer and substitute instead resistance ...apacity coupling.

...The result is an effective widening of ...he IF channel, but with a reduction in ...ain. The difference is not startling, but ...ufficient to make this feature worth ...while on good program material.

...The switch associated with the second ...IF is a 3-pole, 3-position type. As may be noted from the circuit, section 1a is used to short out the secondary of the second IF, leaving only the diode load in circuit. The third position is used to short the diode to earth, thus silencing the tuner when the pickup is in use.

Section 1b removes the .05 mfd decoupling capacitor, allowing the .022 meg. resistor to become the plate load. Under these conditions, the 100pf. capacitor between the B and F pins becomes the coupling capacitor. Section 1c is used to connect either the tuner of the pickup output to the audio section.

When a wide response is required from the tuner, it is necessary to ensure that any trace of regeneration does not exist to make the system unduly selective. We have taken care of this by adding a simple neutralising circuit consisting of a 33pf. capacitor from the plate of the IF amplifier to the "F" terminal of the 1st IF.

An 8 mfd decoupling capacitor from the oscillator supply, shown dotted, may be desirable in cases of instability. However, this would be an exception rather than the rule.

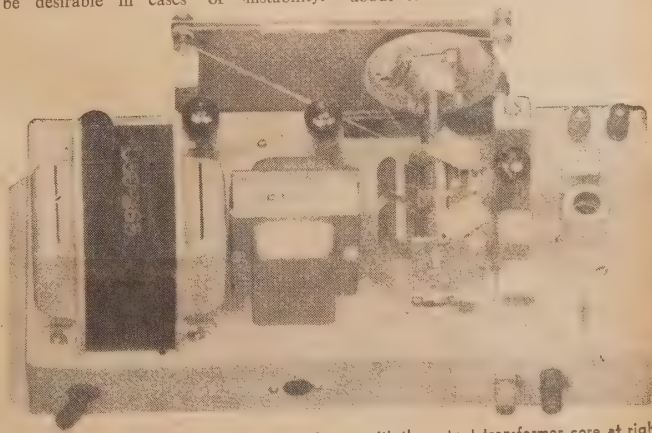
The audio section makes use of the comparatively new 6BM8 valves, which combine a voltage amplifying triode and a power output pentode in a single envelope.

These valves were primarly designed as frame blocking oscillators and frame output tubes for use in TV receivers. However, they may also be used for audio work under various ratings.

The characteristics of the triode section are quite good and, under certain conditions, it is possible to get a gain of nearly 60 times and an output of nearly 40 volts.

The pentode section, with an applied voltage of 250, will give an output of 3.5 watts with a plate current of only 28 mills and a signal input of about 11 volts.

The comparatively low cathode current of the pentode is quite attractive when considering the use of a pair in push pull, for we can expect a nominal output of 7 watts for a current drain of about 65 mills. In practice, the total



A view from the rear shows power transformer with the output transformer core at right angles to it. The terminals are for aerial and earth connections.

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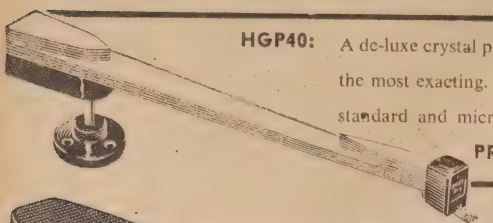

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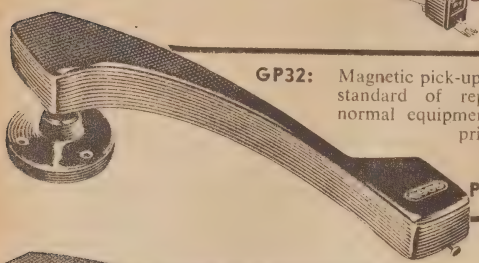
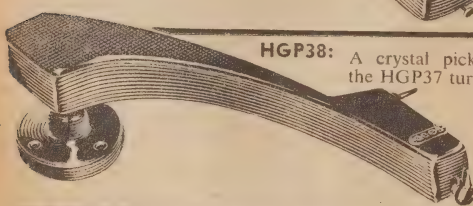


GP32: Magnetic pick-up provides a good standard of reproduction with normal equipment at reasonable price. Output voltage, ½ volt at 1,000 c.p.s. **PRICE, £2/12/6**



HGP38: A crystal pick-up. Incorporates the HGP37 turnover cartridge for standard or microgroove recordings with cantilever stylus. **PRICE, £5/15/-**

GP50: Is a HIGH-OUTPUT crystal pick-up suitable for reproducing standard and microgroove records through *low-gain* amplifiers as used in small record players and some radios. **PRICE, £4/19/6**

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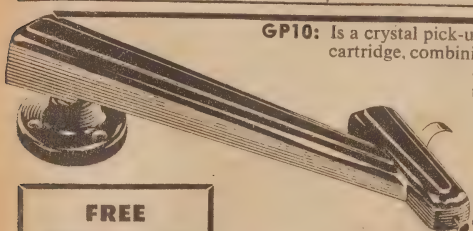

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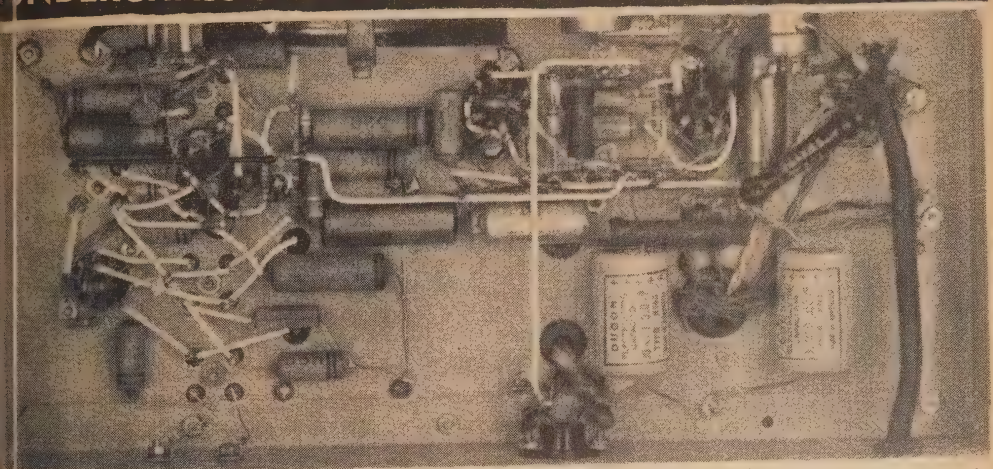

ou can identify many components from this picture. White spaghetti on the wires makes them easier to trace out.

cient drain from the power supply is no much more than that of a conventional 5-valve radio.

he output will vary with the quality of the output transformer used and we hae obtained up to 6.5 watts, from the secondary at 1 Kc, with a medium-quality transformer. This indicates that th nominal 7-watt figure may be reasonably attained in practice.

eedback runs from the secondary of th output transformer to the first triode stge in the now familiar manner. About 14db is used, enough to lower the output impedance by a valuable amount and to reduce distortion by about one-third.

t is possible, of course, to use more feedback with the better types of output transformers, but the input sensitivity wil be reduced.

t is not possible to give a value of compensating capacitor across the feedback resistor which will suit every type of output transformer, but we have found 4000pf to be a safe value. With cheap output transformers it is hardly worthwhile using any capacitor at all, as the gain at the higher frequencies is comparatively low and phase reversal may not prove troublesome.

TONE CONTROL

We have provided a simple top-cut filter in the grid circuit of the first stage, to give a variable amount of treble roll off and it amounts to 20db at 10 Kc in the maximum position.

Such a simple compensator is permissible in a unit of this type. Where an ordinary crystal pickup is to be used, it is quite hopeless to apply standard compensation when the pickup response is likely to be so variable.

It is far better to adjust the top-cut control for best results and leave it at that.

The remainder of the circuit is quite conventional, using a minimum of components to keep the overall cost low. The screens of the output valves are fed through a decoupled supply to reduce the danger from the simple power supply.

The power transformer is rated at 80 mills, which is almost exactly the current drain of the set, a few mills over the edge being permissible, since a capacitor input to filter was not used.

Decoupling the screens of the output valves and the earlier stages allowed us to omit a filter choke, a practice followed by a number of commercial designers, thus removing quite a few shillings from the purchase price. The omission of the filter capacitor after the rectifier reduces the peak current demands on the supply and allows us to draw a current slightly higher than normal from the transformer.

Almost any type of speaker will be suitable for this set, although we suggest a 12-inch type of medium quality particularly if a good output transformer is contemplated. Types which immediately suggest themselves are the Rola 12OX, the Magnavox 12WR and the Jensen twin-speakers.

Altogether, we were very pleased with the neat result of our new radiogram. The design is simple — it is hard to imagine a method of getting as good a performance from so few valves. Its general quality is quite adequate for everyday work, with everyday speakers and pick-ups, and if you use a good output transformer it is good by any standards.

Now for the physical details. The chassis was bent up from 18 gauge aluminium, but heavier gauge of aluminium or steel will do. We shall make blueprints available in the normal manner.

COMPONENT MOUNTING

The mounting of the major components is clearly visible in the reproduced photographs and requires little comment. The under chassis photograph should be an aid to keeping the wiring layout neat.

The dial used is a USL/3. This is not a large dial, but we used it to keep down the overall height. Too much height would have prevented us from using the swinging panel, to which the set is attached, by increasing the arc of travel, and requiring much more area on the front face of the cabinet than was available.

At the same time the dial is quite big enough for easy tuning, is nicely proportioned in its wooden panel, and, of course, is not normally in view as it is not a permanent feature of the cabinet face.

The layout of the tuning section progresses logically, commencing with the aerial coil at the rear of the chassis, followed by the oscillator coil with the converter valve on its left. Directly in front of the converter valve is the second IF with the IF amplifier valve on its right. Directly in front of the IF amplifier valve is the second IF transformer.

SHORT LEADS

The leads between the switch and the second IF transformer are thus kept quite short in the interests of stability.

Most of the tuner wiring is point to point, requiring only one mounting strip. This is a modified 7-lug strip with two lugs nipped off the end facing the rear of the chassis. It is held by a tuning gang mounting bolt.

The first lug nearest the front edge of the chassis supports one end of the tuner output coupling capacitor, the other end of which goes to the switch. This lug is also the junction for the .22 meg diode load and the .047 meg diode filter with its RF bypass capacitor.

The next lug is left blank, although it may not appear to be so in the under-chassis photograph. We wired a divided diode load in the prototype, but this was found unnecessary and was eventually discarded.

The following lug is a high tension point to which are connected the plate and screen dropping resistors of the IF amplifier, the oscillator dropping resistor and the .1 mfd bypass.

An earth lug follows, and to this is anchored the earthy end of the 1 meg resistor in the AVC divider network. The other end of this resistor is soldered directly to pin 8 on the IF amplifier socket.

One lug remains, and is used as the supply point for the oscillator plate and converter screen. It supports the low

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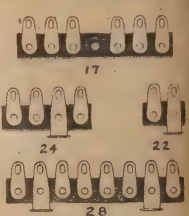

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al end of the oscillator dropping
, with its associate bypass and de-
ng capacitors.
coils and IF's are orientated as
s: Pins A and E of the aerial coil
e rear edge of the chassis, while
and F pins face the front edge.
G and F of the oscillator coil
e rear of the chassis, while P and
the front. The converter valve
is so placed that the gap in the
points almost directly at the IF
ier socket.

IF CIRCUIT

t in line, we have the 1st IF trans-
r of which pins B and P face the
dge of the chassis, while pins G
face the right edge.
IF amplifier socket has the gap
pins facing directly to the rear
of the chassis. The second IF
ormer, directly in front, has pins
d F facing the switch, and pins P
3 facing the IF socket.
suggest that you follow this layout
ep the critical leads to a minimum
th.
witch sections 1a and 1c are those
st the chassis pointing to the right
eft respectively. Mount the switch
angle so that a short connection
be made between the moving arm
ct and the F pin on the IF trans-
rer, likewise between contact one
he G pin. A lead about one inch in
th had to be run from contact one
in 7 on the IF socket, but we did
experience any instability.
shielded lead runs from the moving
contact of section 1c to the volume
trol. It is not necessary to shield
e lead from the pickup terminal to
contact three of the same section, as this is quite short.

The wiring layout of the audio amplifier is very similar to that of the Low Cost Crystal Amplifier featured in an earlier issue, and may be adhered to. However, for those not familiar with that unit, here is the routine to follow.

The valve sockets are mounted with the gaps in their pins facing the front edge of the chassis.

Most of the wiring is suspended between, and anchored to two mounting strips located centrally in front and behind the valve sockets. These are a five-lug and a seven-lug strip respectively.

Commencing from left to right: Lug one is an anchor point for the plate load of the phase changer, the other end being anchored to lug two of the seven-lug strip—a high tension point. The .02 coupling capacitor, to the grid of the outut section of V1, is also anchored at lug one, a lead to pin nine of V2 completes the connection.

CONNECTIONS TO LUGS

Lug two supports the earthy end of the output stage bias resistor, the pig-tail being bent aside to form a shorting link to the next lug which is an earth lug. Lug four supports the lower end of the bias resistor and its bypass, the other ends of which are connected to pin eight on the socket of V1. Lug four is also the junction for the 100 ohm resistor and the lead from the feedback resistor which is mounted on the four-pin speaker socket.

The fifth lug supports one end of the plate load of the first stage, the other end of which is anchored at lug six of the seven-lug strip—a high tension point.

Lug one of the seven-lug strip is a junction for the coupling capacitor between the cathode of the phase changer and the grid of the output stage of V2, the grid stopper and the grid leak of the same stage.

The second lug has been mentioned, while the third supports the cathode end of the output stage bias resistor and its bypass. Lug four is an earth lug and the earthy ends of the output stage grid leaks are anchored to this point.

Lugs five and six are two high tension points, lug five has the main high tension from which the tuner and the screen of the output valves are fed. Lug six is the decoupled side of the 6800 ohm resistor which is anchored between these two points.

POWER SUPPLY

The last lug is an anchor point for the grid leak and grid stopper of the output section of V1 and the coupling capacitor to the same grid.

The remainder of the wiring is wired directly between valve pins including the wiring associated with the tone control.

The wiring of the power supply components calls for little comment since there is adequate room and the placement of components is not critical. A three-lug strip is used to anchor the heater leads, the centre tap and the electrostatic shield leads. The third lug is the supply point for the plates of the output valves.

The volume control has a double-pole switch which is used for the receiver and record player.

Well, that should complete the receiver constructional details. Next month, as mentioned earlier, we will discuss the construction of the cabinet and a suitable method of baffling for the speaker.

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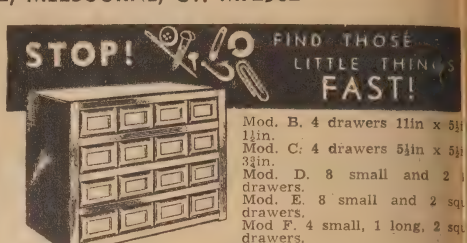

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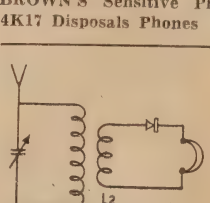

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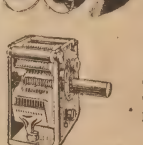

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t there some branch of elec-tnics in which you are an ex-pt? Have you built some un-ual equipment which would erest our readers? Is there me section of our activities which you think you could contribute?

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F when it comes to putting their hts into print, they become modest diffident.

Cerseas, the number of technical ntributors to magazines and periodi-s vast. Naturally the field is much er because there are more people y and to read, but in many cases standard of their efforts is not higher n could be produced here.

Te greatest part of our technical ma-ri is produced by our staff which id to write them, but a leavening tside ideas, provided they are tech-tly sound, we think, would be a good ii..

maybe you have some pet sub-c or some general criticism, which would like to level at the radio od in general. It may be merely or technical point you think is too ft overlooked, or some new slant on old idea.

hy not write us a letter for pub-cion?

HOW TO DO IT

ere are some hints which might help o to see your name in print.

on't concentrate on a subject about ich you can see we are doing develop-ental work of our own. We can't rt too much about the one subject.

void subjects such as "Ohm's Law" but which we already say plenty.

Write about something of which you ve special knowledge, and if you ieeve your ideas are well founded, don't be afraid to say what you think.

f you envisage a big project, send us a resume and perhaps a small sample before going ahead. This may save you work.

If you have a constructional project, make it available for inspection and photographing if you can.

And when preparing material—

Type, if possible, using double spac-ir. Number each page and leave mar-gs of at least one inch all around.

Most circuits we like to draw our-selves, but set yours out clearly and show all values. Don't use components which are hard to get.

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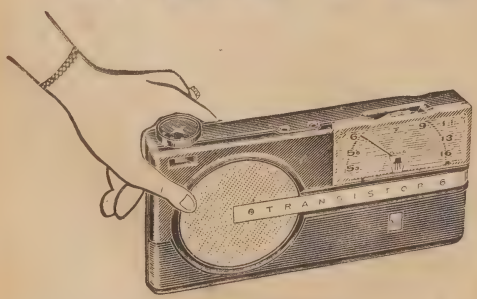

Above is the slim, versatile "SONY" model TR 6 Size 1¼" x 4½" x 8½". Weight 2¼lb. Price £40. Right is the all-purpose "SONY" Model TR 72 for home, outside use, equal in tonal quality to the best electric mantel models. Size 3¼" x 6¾" x 9½". Weight 4¾lb. Price £45.

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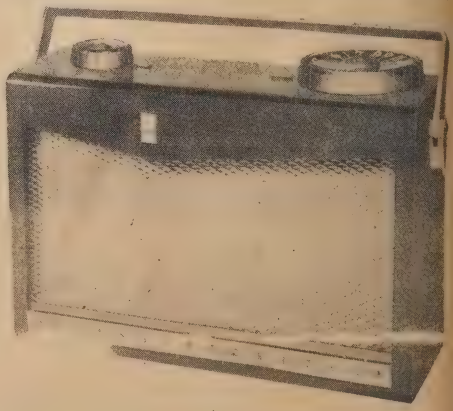

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A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A Simple Home-made Soldering Iron

This article describes a quick-heating soldering iron which is very simple and comfortable to use.

It employs the well-known principle of generating heat at a low-pressure contact between a carbon and a metal surface, and since the latter can be one end of a short copper bit, the thermal inertia of the system is very low, and soldering temperature is attained in a few seconds.

A low voltage source of about 3 or 4 volts capable of supplying a current of the order of 30 amps for short periods is required. Two cells of a car battery will do very well, using large alligator clips for convenience in making connection.

In fact one of the virtues of this type of soldering iron is that it can be independent of mains supplies and does not waste battery power as a slow-heating low voltage element would do.

OPERATES ON AC

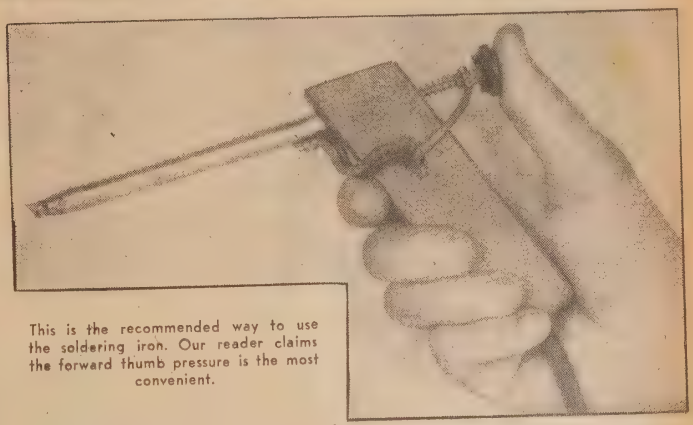
Alternatively, for operation where AC power is available, a transformer with a 4-volt winding capable of carrying about 7 amps continuously is the best solution.

The accompanying photograph shows the general appearance of this soldering iron, and the sectional drawing (not to scale) will make the method of construction clear.

The handle is a piece of timber 1½in by 1in section by 5in long, with a 3-8in diameter hole drilled for 3in up the centre and leading into another 3-8in hole drilled in from the side, through which the flexible cord is taken.

This cord should be of 10 amp rating, or more. The outer tube carrying the element may be of brass or steel. The former is easier to work and gives less contact resistance where the copper bit screws in, but having a higher heat conductivity than steel it wastes some heat.

The tube should be 3-8in external diameter, and about 7-16in internal, a convenient length being five or six inches. One end is made red hot and rolled down in size so that a ¼in whitworth thread can be tapped into it, to take the copper bit which is screwed for about ½in 3-8in at one end.

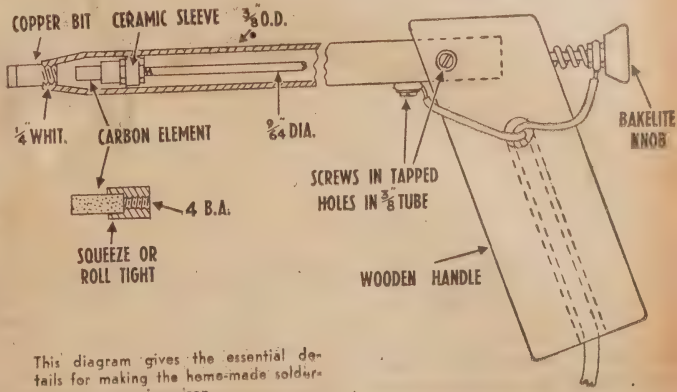


This is the recommended way to use the soldering iron. Our reader claims the forward thumb pressure is the most convenient.

The carbon element is held in a metal sleeve which is tapped with a 4BA thread. The 9-64in steel rod carrying the element is screwed at one end to take the element and an insulating sleeve to support the rod, and at the other end to take the nuts for connection to the flexible cord.

The insulating sleeve should be either ceramic or mica, as it naturally is subjected to considerable heat. The copper bits and carbon elements may be bought at radio parts stores or made up as shown in the diagram.

The pressure applied to the bakelite knob by the thumb should be that which gives maximum heating of the bit. Excessive pressure will reduce the heat at the bit and waste power elsewhere in the circuit. Be sure to discard the carbon element before it has burnt down to its metal support. With average use an element should last some months.



This diagram gives the essential details for making the home-made soldering iron.

Yardstick to health

THE way a person walks often tells a physician what is wrong with him. A person in good physical health has a well-knit system that depends on smooth and close co-ordination of nerves, muscles, bones and joints.

When any section of this system is not working, the body attempts to compensate by transferring the work load to other sections. Thus we get the up-and-down or side-to-side movements that require much more energy than even movement.

Hardening of the arteries is often responsible for the mincing, short-step gait in the aged. Abnormal bone structure in the back and lower limbs is the most common cause of the knock-knee and bow-leg gaits. The awkward, waddling gait in which the individual leans back from the hips as he walks often signifies muscular dystrophy.

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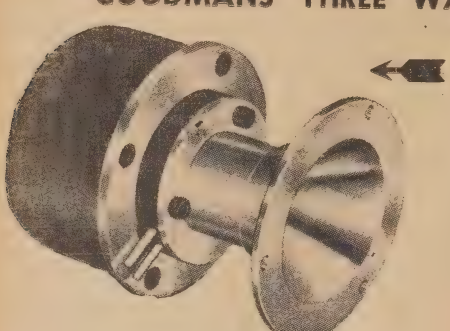

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SPECIFICATION

FREQUENCY RANGE .. .. .. 400 c.p.s. to 8 Kc/s
IMPEDANCE .. .. 15 ohms at 400 c.p.s.
SYSTEM POWER HANDLING CAPACITY .. 25 watts.
CROSSOVER FREQUENCY .. 750 c.p.s. and 5000 c.p.s.

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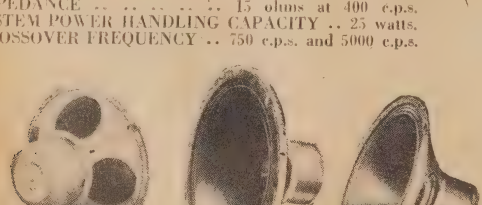
SPECIFICATION

FREQUENCY RANGE .. .. 2,500 c.p.s. to 16,000 c
IMPEDANCE .. .. 15 ohms at 10 Kc
SYSTEM POWER HANDLING CAPACITY .. .. .. 25 wa
CROSSOVER FREQUENCY .. .. 5 Kc



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SPECIFICATION

	AUDIOM 60	AUDIOM 70	AUDIOM 80
FLUX DENSITY	14,000 GAUSS	17,000 GAUSS	14,500 GAUSS
BASS RESONANCE	35 c.p.s.	35 c.p.s.	35 c.p.s.
POWER HANDLING CAPACITY	15 watts	20 watts	25 watts
IMPEDANCE AT 400 c.p.s.	15 ohms	15 ohms	15 ohms

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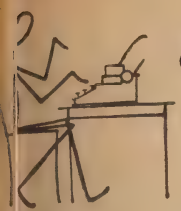


Here's your answer, Tom!

his month's queries are from two individual readers, who have added variety to the run of uestions we have had lately. In recent times, transistors have aroused a great deal of inter- t among serious experimenters, and judging b y the first questions, Tom belongs to this group.

Recently on a "Reader Built It" pe, a Queensland reader stated tl the TS2 transistor had a rated e -off frequency at 500 Kc. Yet, t used an OC71, with a rated cut- o at 300 Kc, as the detector. Would n a TS2 have been better in this p ition? I wish to know this, as I ntend to use an OC73, with a r ed cut-off at 500 Kc, instead of tl OC71, hoping to improve the s sitivity.

V can't answer for the particular ar, Tom, nor for the ideas express- . his article. However, we agree t you that it would appear more g al to use as a detector the tran- t which had the higher rated cut- f equency.

It there may be more to it, Tom. ncut-off frequency of individual tran- t s can actually be well above the st figure and this might have been n the particular case, causing the final constructor to use them as he d.

While ever set-builders have to use ansistors close to their limit frequency, we will have to be prepared for con- iderable variation in performance from one small set to another.

★ ★ ★

What is known as the cathode of te germanium diode? Is it the gative side?

In order to make germanium a semi- nducting material, impurities are add- d to it while in the molten state. Ac- rding to the quantity and nature of ese impurities, the germanium can be ade either P-type or N-type, as re- ired.

Most diodes use N-type germanium.

Two varieties of germanium diode are manufactured, namely, the junction type nd the point contact type, the latter being the most common.

In the point contact type, the "cat's whisker" makes contact with a pellet of N-type germanium, while in the junction type a P-type layer is grown on to N-type germanium.

The N-type pellet acts as the cathode, while the "cat's whisker" or P-type germanium is the anode.

The cathode is usually marked by a color dot which, in some cases, also serves to identify the particular type of diode.

Direction of conduction on this basis is the same as that for a conventional thermionic diode.

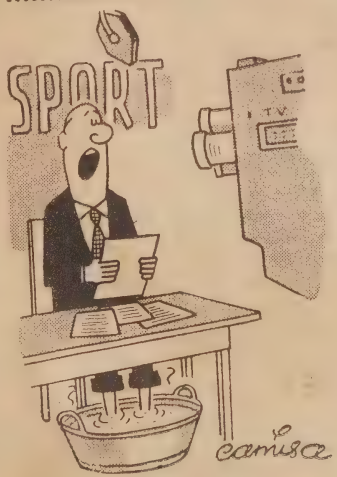
In many circuits, as in crystal sets, the polarity of the detector is not important. In other cases, the diode has to be connected into circuit in a specific fashion, as per the circuit design.

★ ★ ★

The only thing preventing me from winding my own short-wave coils, to suit the gauge of wire that I have on hand, is the inability to apply formulas to work out the number of turns for a given inductance. An edition of the ARRL handbook gives these formulas together with an inductance, capacity and frequency chart. Could you please show me how to work out the formulas?

We have checked the formulas to which you refer, Tom, and find that they involve ordinary High School algebra. It would not be possible for us to show you how to apply these formulas without giving you a course in algebra.

The best advice that we can give is to purchase a text-book on algebra and study sufficient to enable you apply these and similar formulas.



— TV TIMES

Why is it that, when a copper band is placed around a transformer to reduce radiation, it does not act as a shorted turn and damage the transformer?

In actual fact, Tom, the copper band does act as a shorted turn, but only to the external field, which would normally be radiated into space. That is why it is put around the outside of the laminations and only partially around the winding.

If the band was placed directly around the winding, it would behave as a shorted secondary winding. Excessive current flow would take place, with resultant over-heating and eventual destruction of the transformer.

★ ★ ★

I have an audio transformer marked 3½ to 1 ratio. I know that the secondary has 3½ times the number of turns in the primary. Another type that I have shows the ratio as 1 to 3½. Am I correct in assuming that this transformer has a step-down ratio?

Your confusion seems to have risen over the terminology used.

In the days when audio transformers were extensively used for interstage coupling, it was common to refer to the proportion between the number of primary and secondary turns, and express it as a step-up or amplification ratio.

In more recent times it has become customary to refer to the ratio between primary and secondary in that order.

So, Tom, your transformers are probably similar, one being of more recent origin than the other.

★ ★ ★

I would like to convert an 0 to 80 volts DC meter to read milliamps. Can I do so without damaging the meter?

The meter that you have on hand is probably a disposals type. These are generally low-sensitivity instruments, requiring from 5 to 10 mA for full-scale deflection, with a built-in multiplier resistor to convert it into a volt meter.

To use it as a milliameter it would be necessary to disconnect the multiplier and establish the current required for full-scale deflection. If you wished to extend the milliamp ranges by means of shunts, it would be necessary to know the internal resistance of the meter movement.

Unless you are capable of performing these operations successfully, we do not suggest that you tamper with the meter. Meter movements are easily damaged and are expensive to repair.

★ ★ ★

In a five-valve radio I have, the rectifier plates glow red on switching on. I have replaced an electrolytic which was hanging loose, but the plates still glow. Can you suggest any reasons for this behavior?

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Part No. 62	6.3v .6amp 5Kv. insula.	Price 26/8
Part No. 63	Frame Output Trans. 6BM 8.	33/4

Part No. 200	Sound IF	Price 11/4
201	Ratio Detector	11/4
202, 203, 204	Video IF's	11/4
504	4 Pin Coil Assembly	4/8
505	5 Pin Coil Assembly	
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408	Aer. RF Choke C.T. 2uH	3/4

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22	5amp Line Filter with condensers	90/-
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he symptoms you have described in- e excessive loading on the rectifier to a short from high tension to earth r after the filter system.

number of components may be re- sible, including the electrolytic capa- rs, the choke, the output transformer, HT bypass capacitors present, and leads carrying high tension and h run close to the chassis.

he logical way to go about finding fault, Tom, is by a continuity test. a ohm meter is not available, a panel and battery will do nicely.

isconnect the high-tension line at the t to the filter, and connect the lamp eries with the battery, between the i-tension line and chassis. If the p lights, a short exists.

Working on, disconnecting the line at point of junction to each suspected ponent until the lamp no longer ts. You will then know that the ponent or leads just disconnected are fault.

★ ★ ★

I have frequently seen reference nade to oscillator tracking, what is neant by this?

You are undoubtedly aware of the nciple of superheterodyne reception. A signal generated by a local oscillator is nde to beat against the broadcast signal t which the receiver is tuned. The nixing action is accomplished in the con- verter valve, the resultant signal being ean "intermediate" frequency.

The intermediate frequency most idely used today is 455Kc.

Since the broadcast frequency band ex- tends from just over 500Kc to about 1600Kc, the oscillator must tune upwards om about 1000Kc, always above the equency to which the set is tuned.

This leads to difficulties with ganged ning capacitors because the ratio of aximum to minimum frequency cover- d by the aerial input circuit is different om the ratio which has to be covered the oscillator tuning circuit.

In order to restrict the tuning range the oscillator circuit and to keep it 455Kc above the signal circuit (or cir- cuits), various measures have been adopt- ed.

In technical language it can be said at such arrangements make the oscil- tor "track" with the signal circuits.

One idea, which has been used over- as a good deal, is to have a gang capa- tor with specially shaped plates for the scillator section only. If the design of ich a capacitor is accurate and every- ing is correctly adjusted, the "tracking" n be virtually perfect.

More common practice is to connect a apacitor in series with the oscillator ning capacitor and thus restrict its effec- ve maximum value.

This extra series capacitor is common- referred to as a "padder" and its value nust be set quite accurately for good scillator tracking.

With the older air-cored coils the pad- er was normally adjustable. With mod- rn variable iron-cored coils, a close olerance fixed mica capacitor is normally sed, 425pF 5 pc being a common figure or the broadcast band.

The padder idea cannot give perfect racking because of the law of the two eries capacitors. However, it can be uite close enough for all practical pur- poses. A well-designed and adjusted set sually exhibits perfect tracking at three points on the band—near the centre and near the two ends; in between some in- accuracy occurs, but not enough to pre- judice noticeably the performance.

★ ★ ★

How does one calculate the power consumed by a radio set?

Special meters are available for the measurement of the AC power input to appliances. However, you are not likely to acquire one of these at a reasonable cost and, in the absence of such a meter it would be necessary to find the sum of the powers consumed by individual sections of the receiver.

Taking an average 5-valve set as an ex- ample, there will be five heaters operat- ing from the 6.3 volt winding, at a cur- rent drain of approximately 1.8 amps. In addition there may be two dial lamps drawing .6 amps. The total current drain from the 6.3 volt winding is therefore 2.4 amps, and the power consumed will be 6.3 multiplied by 2.4, equal to 15.12 watts.

The rectifier valve will require 5 volts at 2 amps to add another 10 watts for the heater circuits.

The high tension requirements will most likely be 250 volts at about 80 mA or amounting to another 20 watts.

Allowing another 5 or 6 watts for losses in the rectifier and filter system, the total figure will rise something like 52 watts. This is not the end of the story, however.

The efficiency of power transformers varies a good deal with size, but the efficiency of the average 80 mA trans- former will be in the vicinity of 85 pc. Making allowance for the losses in the transformer, the total power consumed will be 52 divided by 85 and multiplied by 100, which equals 61 odd watts.

Older sets equipped with a field coil will require slightly more power, but this extra load, including the losses of the power transformer, are not likely to in- crease the total consumption by more than a further 10 watts.

From the foregoing we can see that the average set does not consume any more power than the average electric light globe.

★ ★ ★

I have seen various solder ratings such as 50/50, 60/40, etc. What is the difference between these and plumbers' solder? Can plumbers' solder be used for radio work?

Ordinary solder is an alloy of two metals, tin and lead. The figures refer to the percentage content of each in the solder in the above-mentioned order.

For general-purpose soldering 50/50 solder is excellent. It contains equal amounts of tin and lead, and melts at a temperature of 370 degrees Fahren- heit. It is easily melted by applying a hot copper bit to the work being sol- dered.

A better solder, but a more expensive one, contains 60 pc tin and 40 pc lead. It melts at a temperature of 340 degrees Fahrenheit and is the most widely-used solder for radio work. It is called 60/40 solder.

Coarse solder contains 40 pc tin and 60 pc lead, while plumbers' solder con- tains 34 pc tin and 66 pc lead. These melt at temperatures of 400 degrees and 440 degrees Fahrenheit respectively, and because of this are frequently melted by

(Continued on Page 91)

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by Maurice Findlay

ALMOST since radio began as a hobby for the homebuilder, there has been a place for a small receiver using regeneration to improve the performance. Even in our very first issue, dated April, 1939, a regenerative receiver using a twin triode valve appeared. The heater of the valve was operated from the power mains via a transformer, while a battery was used for the high-tension supply with the idea of saving on the cost of the power supply and simplifying the circuit.

In the following issue a similar set was described, this one using a battery valve and operating entirely from dry batteries.

PROBABLE RESULTS

Since then, small regenerative receivers of many different types have been built for both battery and power mains operation, some using separate valves for various functions and others saving on cost by making use of multi-purpose valves.

Early in the history of these sets it was realised that, provided suitable coils were available and a reasonable aerial erected, good reception from the more powerful overseas stations could be obtained.

Generally, the coil was wound on a tube about one inch diameter and fitted with a plug to enable it to be plugged into a valve socket. The coil to cover the broadcast band was generally wound first and a number of coils to cover the various higher frequency, or shortwave, bands made up as required.

Reports came in from all over the country of strong signals from the BBC in London and from America, as well as many other places, and there was no doubt that people who were prepared to tune and adjust the reaction carefully could expect reception to rival quite elaborate commercial receivers.

Just to remind you of the idea of reaction, the incoming radio frequency signal is amplified by a valve and some of the amplified signal applied back to the input. If the amount of the energy fed back is carefully adjusted it can be used to make up for inefficiencies in the tuned circuit. The result in practice is that the amplification of the set increases markedly and that the selectivity, or ability of the set to separate stations close together in frequency, is improved.

If the amount of energy fed back into the circuit is too great, the detector will oscillate, in other words, produce a radio frequency signal on its own accord. The trick is to operate the detector just below the point of oscillation where the improvement in gain and selectivity can be comparable with that obtained by adding an extra valve and tuned circuit. In fact, in many cases the selectivity will be even better than with two tuned circuits and no regeneration.

Provided the detector slides into oscillation very smoothly, it is permissible to allow it to oscillate weakly when a beat note will be produced between the incoming signal and the signal generated by the detector itself. Reception of unmodulated morse code signals is then possible without the need for a special beat oscillator as is normally fitted to more elaborate receivers.

One of the reasons for the use of plug-in coils for shortwave operation in the early sets was that switches were relatively scarce and expensive. Also most experimenters liked to try different amounts of feedback and aerial coupling.

COIL SWITCHING

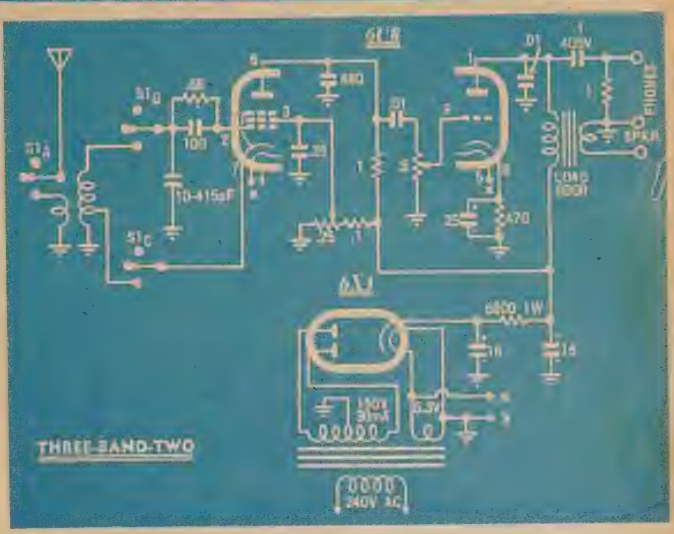
Switches of excellent quality are in good supply these days, and a good understanding of the operation of the detector enables us to give a set of coil data which will suit most readers and conditions. Some may wish to make slight alterations to the published data, but it is most likely to be concerned with the number of turns on the aerial coil.

Therefore, it is a practical proposition to wind the coils on small-diameter formers (¾-inch in this case) and select the band required by means of a switch. There are then no loose coils to become damaged or lost.

Mechanical layouts with small regenerative receivers have varied throughout the years, special advantages being

Blueprints for the metal chassis will be available through the query service but there is no objection to a wooden chassis if you would like to save money.

THE SIMPLE RECEIVER CIRCUIT



Circuit values have been chosen with care to give the greatest possible gain and at the same time ensure stability and reliability. High frequency audio response is deliberately reduced to aid reception on crowded shortwave bands and prevent feedback within the valve itself.

ared for various schemes. However, the problem is quite different from that ountered in larger receivers where may be a number of amplifiers ding at radio frequencies on the sis chassis, not to mention high-fre- cy oscillators.

terstage shielding is not of any spe- importance in a simple regenerative ver of this type. It is simply ne- ry to make sure that the compon- of the tuned circuit are mechanic- firm and that the dial mechanism nooth and capable of returning to ven setting with accuracy.

TAL CHASSIS PREFERED

owever, the tuned circuit should be ded in some way from the operator hat a carefully-set adjustment is not rbed when his hands are removed n the controls. Often a metal front el is sufficient or possibly the metal e of a dial. A metal chassis is also ood thing, but if you would like to on cost by making a chassis from wood, the difference would hardly be ced.

therwise it is a matter of mounting chassis components firmly in the most venient place and at the same time ring sure that all solder joints are d both electrically and mechanically.

We will have more to say about the hanical side of the set later in the cle when we discuss the actual mbly but in the meantime there are number of points about the electrical uit of the receiver which are of cial interest.

For example, the valve we have used is modern type designed originally for in television receivers. It is a type 68 and combines a triode and a pen- e in the one envelope, both sections ving very good performance figures en compared with single valves.

We considered very carefully how the to sections of the valve may be best ed in the circuits of a one-valve re- ver and decided that the pentode ould be connected as a "leaky grid" tector with the triode as an audio plifier feeding the loudspeaker or adphones as the case may be.

HE PENTODE SECTION

Taking the pentode section first, but thout going into too much detail, the id and cathode of the valve behave as e plate and cathode of a diode which tects (or rectifies) the incoming sig- l. But the grid of the pentode actu- y takes a dual role, behaving as the rmal grid of a pentode audio ampli- r which amplifies the detected audio nal.

By using a high value plate load th the pentode it is possible to achieve high gain, in fact, considerably gher than would be possible with a ode valve.

Feedback for the regenerative circuit obtained by placing a tap in the wind- g and returning the cathode to this oint. If you study the circuit in detail ou will note that both the screen and e plate of the pentode are at earth otential as far as radio frequencies are ncerned because of bypass capacitors.

Therefore, for radio frequencies, the ate and screen of the valve are con- ected to the lower end of the coil and is not difficult to see the similarity between the circuit and the classic Hartley arrangement.

Practical advantages of the circuit are that a single tapped coil rather than a tuned winding plus reaction winding is required and that the regeneration can be controlled simply by varying the voltage on the screen of the valve with a potentiometer.

The position of the tap on the coil is quite important because it governs the screen voltage at which the valve will go into oscillation. The gain of the valve as an audio amplifier is closely connected with the screen voltage, increasing as the voltage increases from zero and then suddenly dropping off if a certain voltage is exceeded.

The optimum position of the tap is that at which the screen voltage is as high as possible without the danger of exceeding the peak gain value under special conditions, say, when the aerial is resonant and likely to absorb a lot of energy from the tuned circuit.

Output from the detector valve is fed into a potentiometer. The moving arm of this potentiometer goes to the next stage so that any desired fraction of the detector's output can be passed on. This serves as a volume control and is most important in the operation of the receiver.

THE TRIODE STAGE

There will be cases when, with the full available gain, the output volume will be too great. Backing off the regeneration control would spoil the selectivity and allow interference from strong stations near in frequency to the desired station. With the volume control in circuit, the optimum position of the reaction control can always be used.

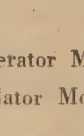
The triode stage provides a worthwhile amount of audio frequency amplification and at the same time matches efficiently to the load presented by a loudspeaker or a pair of headphones. The power output is sufficient to oper-

PARTS LIST

Front panel, 9in. x 5⅜in.
Chassis, 8in. x 5in. x 1⅝in.
Dial, Efco USL/37.
Switch, 3 x 3 single bank.
Tuning capacitor, Roblan single section 10 to 415 pF.
Power transformer, 150 V at 30 mA and 6.3 V.
Speaker transformer, to reflect 8,000 ohms from VC.
Valves, 1 6U8 and 1 6X4.
Capacitors, 1 25 uF 40 V, 2 16 uF 350 V, 1 0.25 uF 400 V, 1 0.1 uF 400 V, 2 0.01 uF 400 V, 1 680 pF ceramic or mica, 1 100 pF mica.
Resistors, 1 1.0 meg ½ watt, 1 0.68 meg ½ watt, 1 0.5 meg potentiometer, 1 0.25 meg potentiometer, 2 0.1 meg ½ watt, 1 6,800 ohm 1 watt, 1 470 ohm ½ watt.
Sundries: 4 knobs, 5 terminals, 2 tag strips, 1 9-pin miniature socket, 1 7-pin miniature socket, length of ¾in diam. paper tubing, scrap sheet metal, length 32 guage B & S enam. wire, length 24 guage B & S enam. wire, hook-up wire, solder lugs, power flex, power plug, nuts and bolts etc.

TEST EQUIPMENT

Klemt	V.T.V.M. Model 200
Cossor	Sweep and Marker Generator Model B23A
Taylor	Wide Range R.C. Oscillator Model 191A
Cossor	3in C.R.O.
Palec	M32 Multimeter
	MX32 „
	MX47 „
	VCT/3 valve and circuit tester
	ET4A valve checker



University	MVA/2 Multimeter
	YOA Oscillator
	TVR/C3 3in C.R.O.
	AVR/C5 5in C.R.O.
	MK1 Multimeter Kit
	OK1 Oscillator Kit

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½ meg pot/switch . . . . . **4/11 ea.**
15 core cable .. .. **3/6 y**
6in speaker box .. .. **2/6 e**
6.3 volt M.B.C. Dial lamp .. **6d e**
12in Hi-Fi speaker 45/12KC **19 Gn**

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Arm	£6/7/11
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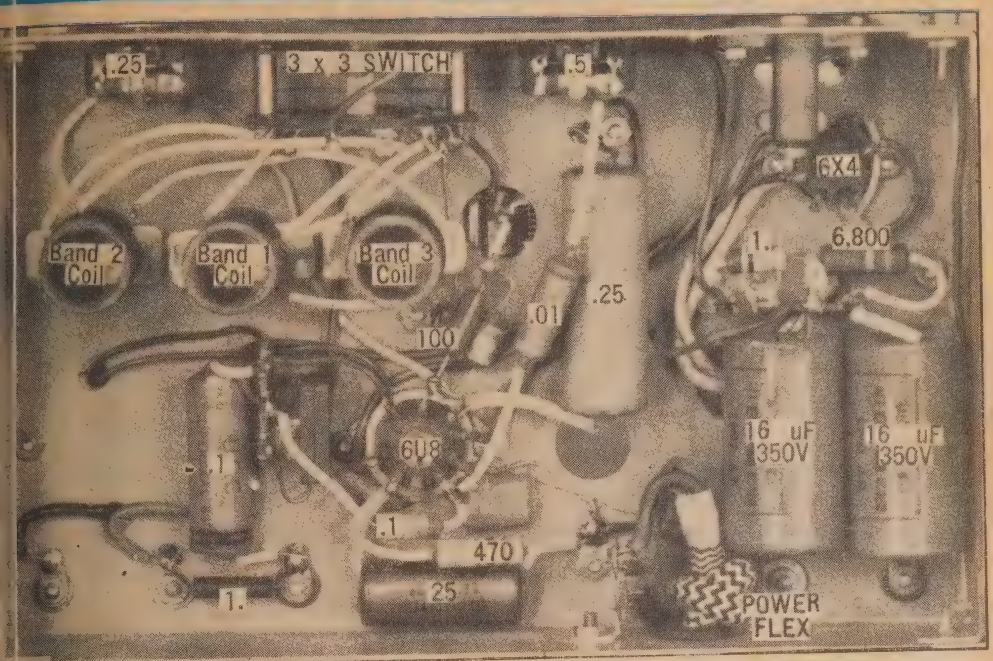
B110	79/
B5210	£9/3/
Acos	
Mic 35	55/
Mic 16	£24/19/
Philips	
Dynamic 1115	£10/17/
Pencil	£52/5/

LARGE-SIZE PHOTOGRAPH SHOWS WIRING PARTS



Pictically every component under the chassis is identified in this large size underneath photograph. There is plenty of room for everything and placement of wires and small parts is not critical.

el loudspeaker at a really worthwhile
olume.
'e measured it accurately with the
id of an oscilloscope and an audio
gal generator and found that 250mW
a available with small distortion. This
bout the same amount of power or
eraps a little more than is available
rc an ordinary portable receiver.
iven a sensitive speaker you will
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ower output is not the same thing
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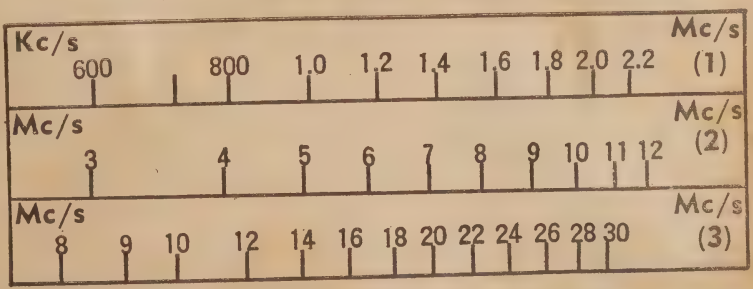
power output of the output stage, you
ri find that with distant and overseas
tions the tendency will be
o turn the volume control
u on.
reater effective amplifica
ic can be obtained by using
a air of headphones. If you
ne low impedance phones
thousands were sold through
disposals dealers after the
war) they can be connected to the speaker voice coil winding of the transformer. The load presented to the valve will not be optimum from the point of view of power output, but will give good gain which is obviously the main requirement.

If the phones are of the high impedance type, best results will be obtained by connecting them from the plate of the output valve to ground through a capacitor. A special terminal is provided for this purpose.

A resistor is shown connected across the high impedance headphone terminals and at first glance it may not appear to be necessary. Its purpose is actually to prevent the coupling capacitor discharging and hence the output terminal coming up to the potential of the plate of the valve. When this happens, it is possible to get a slight shock by touching the output terminal. The presence of the resistor ensures that the capacitor is charged and the DC potential of the output terminal at chassis level.

A small fixed capacitor is connected directly from the plate of the output triode section to ground. It may not be strictly necessary in all receivers but we feel that it is well worth including since it prevents amplified radio frequency signals appearing at the plate of the valve and possibly being fed back into detector. The most serious practical result of this is that the regeneration is affected by the setting of the volume control.

Very small power transformers and rectifier valves are available these days and there isn't much argument in favor of using a battery rather than a mains



his dial scale is full size nd applies to the Efco dial hen used with the Roblan uning capacitor. Copies rinted on art paper are vailable through the query service

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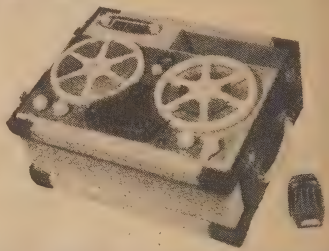

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ed high tension supply unless per-
on the grounds of simplicity.
I'm so, we don't think that any
rs who are quite happy about wir-
p the rest of the set will have any
ble with the power supply which in
ase consists of a small power trans-
er, a rectifier valve, two electrolytic
itors and a resistor. The resistor is
e in the position normally occupied
e filter choke. High tension filtering
cellent and there is a substantial
g in cost by omitting the choke.

r our laboratory model of the set
hose a chassis 8 inches by 5 inches
7/8 inches. The last was chosen as
the minimum which would allow a
h and the coil formers to be fitted
ortably underneath. The other
nsions could easily be made much
ller if you have any special reason
o doing but most readers will want
set for use at home when there
n't seem to be much point in trying
amp the parts into as small a space
ossible.

UNING DIAL

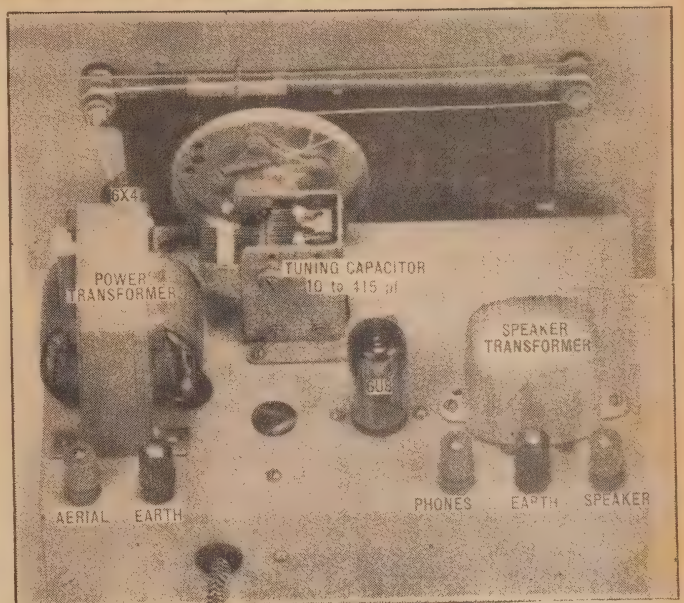
pace has been left for an extra valve
ich can be added later if you wish.
re is plenty of current available from
power transformer and the extra
e will allow speaker reception in the
s where headphones would other-
be required.

or some reason there does not seem
e a dial particularly suited to this
of receiver available on the local
ket at the present time. The require-
nts are, first and obviously that it be
pensive and in good supply. It
uld be capable of being calibrated to
t individual requirements and most
portant of all should be smooth in
ration with no backlash between
b, pointer and tuning capacitor.

Frankly, we don't think that we have
ound the ideal answer but at the same
e the dial we have chosen will serve
y well. We have taken an Efco
LL/37 straight line dial and modified it
to suit our purpose by removing the
iginal calibrations from the dial glass
and placing a calibrated scale behind the
pointer.

A full-sized drawing of our original
ale is published here and provided you
e the same dial and tuning capacitor
nd at the same time make the coils
exactly according to the specifications we
ave given, the dial calibrations will be
curate enough to satisfy all but the
ost fastidious.

COMPONENTS ABOVE CHASSIS



Major components are identified in this view looking down on the chassis from the rear. There is room for an extra valve if later you would like to have a reserve of audio gain for louder signals.

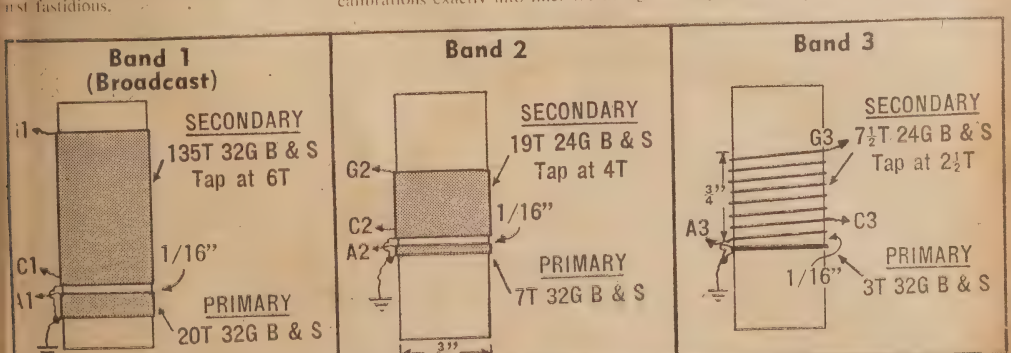
If you are really fussy, the receiver can be made to cover down to a slightly lower frequency by adding a few turns to the tuned winding of the coil or to cover a slightly higher frequency by removing a few turns. This applies to each of the three bands.

The other adjustment you can undertake is to shift the position of the dial drum which will have the effect of shifting the entire set of calibrations to one side or the other. Alternatively, you can achieve the same result by shifting the dial pointer in relation to the cord.

Large receivers often include coils with variable ferromagnetic cores and trimmer capacitors to bring the dial calibrations exactly into line. We thought about including some such adjustments in this set but eventually decided against the idea for the reason that it would add that much extra to the cost and complexity.

We have arranged to have dial scales printed on art paper and these will be available through the query service for those who would like a neatly finished receiver and who do not wish to disfigure the magazine. Two copies of the scale will be forwarded for the normal 2/- query fee.

Of course, if you already have a smooth acting dial and can borrow an accurate service oscillator, then there is no reason why you should stick to our original suggestion.



Full winding information for the three coils is given here. Turns specified are suitable for most conditions but it is permissible to reduce the number of turns on the aerial coil to improve selectivity at the expense of gain.

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SC-1 for standard 78 r.p.m. records.
SC-2 for microgroove 33⅓/45 records. Use with Acos G.P.25 and G.P.29 series turnover cartridges.

SD-1 for standard 78 r.p.m. records.
SD-2 for microgroove 33⅓/45 r.p.m. records. Use with Acos H.G.P.33 series turnover cartridges and with Acos H.G.P. 33⅓/Garrard and Acos H.G.P. 33⅓/Collaro replacement pick-up heads.

SE-1 for standard 78 r.p.m. records.
SE-2 for microgroove 33⅓/45 r.p.m. records. Use with Acos H.G.P.37 series turnover cartridges and with Acos H.G.P.37/Garrard and H.G.P. 37/Collaro replacement pick-up heads.

SK-1 for standard 78 r.p.m. records.
SK-2 for microgroove 33⅓/45 r.p.m. records. Use with Acos G.P.59 cartridges.

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THE RADIO MART

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Assembly of the set isn't any harder than putting together one of the toy constructional sets.

Start by mounting components on top of the chassis. Power transformer, output transformer, tuning capacitor, valve sockets and terminals should all be securely fixed in place with 1-8in diameter 6BA nuts and bolts. Wire

The nine-pin socket for the 6U8 is connected with pin 2 (the pentode grid) nearest the front of the chassis.

Rubber grommets should be placed in the holes for the power transformer leads and power cord to prevent possible sharp metal edges cutting through the insulation and causing a short circuit. Use an insulated washer and a solder lug under the nuts holding three of the terminals. The two earth terminals connect direct to the chassis and the insulating washer is not required. At the same time a solder lug should be included, since it is unwise to depend on the metal chassis for a good connection.

Two tag strips, one near each valve, to some of the small components which are not otherwise conveniently supported and help to keep the wiring neat and firm. A third tag strip near the hole for the power cord supports the joints between the power cord and the wires from the power transformer.

Although the wires under the chassis are normally well protected and out of the way we suggest wrapping some insulating tape around them just in case a soldering iron, screwdriver or, worst of all a finger happens to get into the wiring place while the power is on at some later date. A lot of damage can be done before a 10 ampere mains fuse goes.

DIAL MECHANISM

The tuning dial has to be taken to pieces and reassembled to fit in with the requirements of the new set. Remove the dial drum, the control spindle and completely disconnect the cord. The control spindle is then mounted on the right-hand side of the chassis looking from the front. Use a bolt with a countersunk head in the inside hole so that the dial can fit flat against the chassis.

All control spindles will be longer than required and it is easiest to cut them before they are fitted to the chassis. In this case they were cut so that they protrude about one inch.

As you will see when examining the set the distance between the chassis and front panel (and hence the required length of the control spindles) depends on the thickness of the moulded escutcheon. This was originally designed for mounting in the front of a wooden cabinet and is therefore thicker than needed for the metal front panel.

We thought it worth the trouble to file most of the flange away, leaving just enough to be flush with the rear side of the panel, which does away with the "tunnel" appearance when the full escutcheon is used.

The dial mechanism is held to the chassis by means of two 1-8in diameter bolts, but at the same time the two centre controls assist the small bolts when the retaining nuts are tightened.

If you are using the printed dial scale remove the original dial glass and cement the scale to the metal plate. (Behind the pointer but to occupy the same position when seen from the front as the original scale.) The original calibrations on the dial glass should then be scraped off, say with a razor blade, the glass cleaned and replaced in its original position.

The front panel can now be mounted permanently, using long 1-8in diameter bolts and pieces of brass tubing ¼in OD ¼in long as spacers. If you decide to calibrate the scale yourself the panel mounting should be done later.

WIRING DETAILS

All wiring under the chassis, except that between the coils and the band-switch can now be completed. It is a good idea to run a length of tinned copper wire around all earth points just in case one of the points does not happen to make good contact with the chassis because of paint on the surface. Don't forget to earth the centre shield of the 9-pin socket.

The next logical step is to make connections where wires only are involved. For example, the wires between the power transformer and the rectifier valve, the wire from the centre of the volume control to pin 9 of the 6U8 socket, the wire from the centre lug of the reaction control potentiometer to pin 3 of the 6U8, etc.

SMALL COMPONENTS

Wiring components can be installed next. The 16 uF electrolytic capacitors are supported at the high tension end by the tag strip near the rectifier valve socket. The same strip supports the 6800 ohm filter resistor in the high tension lead together with the 0.1 megohm resistor leading to the reaction control potentiometer.

The 0.01 uF bypass and the 0.1 uF coupling capacitor at the plate circuit of the 6U8 triode section are conveniently supported by a tag strip near the valve socket.

The remainder of the wiring components are small enough to be supported directly between circuit points with their connecting wires. Where the wires are longer than about ½in it is a good idea to use spaghetti tubing to obviate any possibility of short circuits.

The important job of winding the coils has been left until last. For a start you will need some tubing about ¼in diameter. Polystyrene and bakelised paper are excellent for the job.

Each former has to be 1¾in long and it is necessary for this dimension to be accurate, particularly for the broadcast band because there is only just sufficient room to wind the coil and at the same time if it is longer than 1¾in it will not fit under the chassis.

The taps can be made either by twisting a loop into the wire or by terminating it at the appropriate point with the aid of a pair of holes side by side.

The formers have to be held in position under the chassis and no doubt many readers will find satisfactory methods for their own case. We made two diagonally opposite cuts in the tubing, each about ¼in wide and 3/16in from the chassis end.

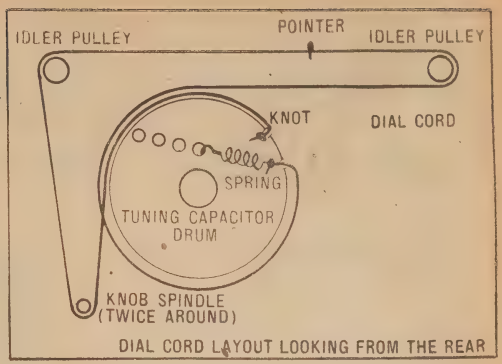
Then, a piece of scrap metal (either 16 or 18 gauge would be suitable) about 1in long and ¾in wide with a hole through the centre is passed through the slots cut in the coil former. A ¼in bolt passing down through the chassis and through the hole in the scrap metal will then hold the coil former firmly.

(Continued on Page 128)

☆

The dial assembly is taken apart and re-assembled with the cord according to this diagram. Position of pointer or dial drum on capacitor spindle can be adjusted to make calibrations correct.

☆



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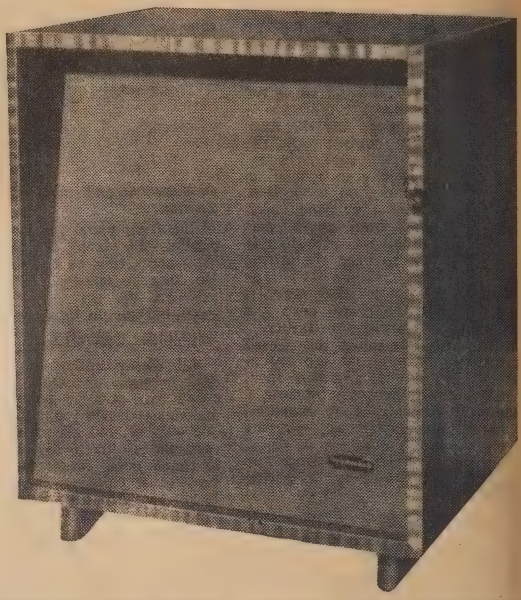

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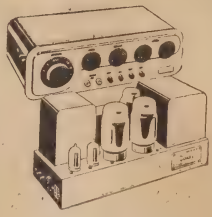

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IMPLE COURSE IN RADIO—5

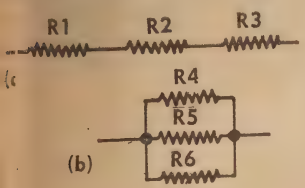
he Fundamentals Of uned Circuits

Simple connections, Complete and Open circuits. The effect of resistance. Ohms Law. Resistors in series and parallel. Inductors and inductive reactance. Inductors in series and parallel. Capacitors and capacitive reactance. Impedance. Resonance, parallel and series tuned circuits.

he word "circuit" is very broad in its meaning and needs an explanation rather than definion. An electrical circuit is perhaps best regarded as a combination of conductors and comonents intended to control the movement of electrons in a specific manner; or alternatively to cause an electric current to perform some desired task.

E concept of controlling the movent of electrons is fundamental. hen a house is in the process of iing, the plumber instals a water rcuit, which carries the water from e street mains to certain parts of the se.

le pipes are made large enough to r the expected flow of water, and ppances are designed on the assumpn of a certain maximum expected r pressure. The taps at the end of



gure 3. Resistors in series (a) and parallel (b).

ar run provide a means of controlling hquantity and duration of flow.

An electrical circuit is designed just s deliberately. There are conductors o ad electrons along certain paths and n lators to prevent them flowing in ter directions. Resistance, inductance n capacitance all have a definite part o play.

he natural urge at this stage is to sent a series of mathematical form ae setting out in precise fashion the tion of these circuit properties.

A SIMPLE CIRCUIT

lowever, not everybody is equally at ne in the realm of mathematics and o aim is rather to impart a clear mena picture of conditions in various elecral circuits, deriving the few basic mulae in as natural a fashion as posle.

Consider the simple circuit arrangent of figure 1, in which a small torch lbe is connected by means of wires and a ocket to a dry cell. The connections a illustrated pictorially and by means o a schematic circuit.

Remember that there is a surplus of e electrons at the negative terminal o the battery and positive ions at the sitive terminal. Immediately the conctions are made, as shown in figure 1 electrons move along the wire "a" to the connection shown beneath the lamp socket.

An insulating washer separates this bottom connection from the rest of the socket, so that there can be no direct movement of electrons across it. Instead, they move along the centre pin of the socket, which is bearing against a metal blob in the base of the lamp.

ELECTRON MOVEMENT

Because there is still no alternative path, the electrons move along the leads within the globe, through the fine metal filament, thence to the metal shell forming the base of the lamp.

This latter is in contact with the metal shell of the socket, so that the electrons pass on to this shell, thence to the terminal, the wire "b" and back to the positive terminal of the battery.

This forms a complete electric circuit, which is often described as being CONTINUOUS.

Provided the lamp is of suitable pattern, the flow of electric current as described will cause the lamp filament to glow—but various circumstances could prevent this desirable state of affairs from being realised.

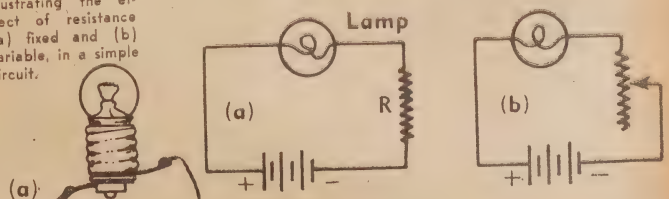
For example, the washer in the base of the socket could conceivably split sufficiently to allow the two portions of the socket to touch one another directly: the electrons, instead of flowing through the lamp, would then take the easier path across the socket and the unwanted result would be described in technical parlance as a SHORT-CIRCUIT.

If one of the leads were to be snipped through, or the lamp partially unscrewed from its socket, the electron path would be interrupted and the globe filament would fail to glow. This circumstance is described aptly by the term

OPEN CIRCUIT

The switch on an electric torch, o on the wall of your home, is simply a device which makes and breaks the electrical circuit between the globe and the

Figure 2. (Right), illustrating the effect of resistance (a) fixed and (b) variable, in a simple circuit.



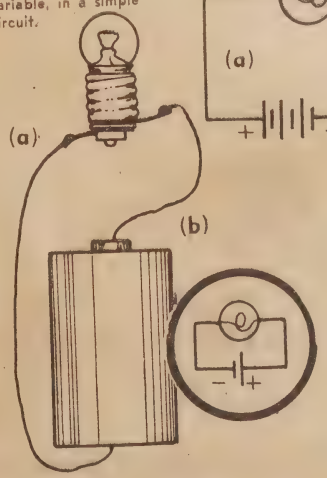


Figure 1. An elementary DC circuit, involving a torch globe, a socket and a cell.

source of power. When moved to the "off" position, it opens the circuit; in the "on" position it closes the circuit.

Consider now the schematic diagram of figure 2, which shows a lamp and a resistor connected in SERIES. The word "series" indicates that the components to which it refers are connected end-to-end, electrons moving first through one, then the other.

The complementary term CONNECTED IN PARALLEL indicates that the particular components referred to are connected side-by-side in the circuit, so that the electron flow divides between them.

A SERIES-PARALLEL circuit is one in which the individual circuit components are connected, some in parallel

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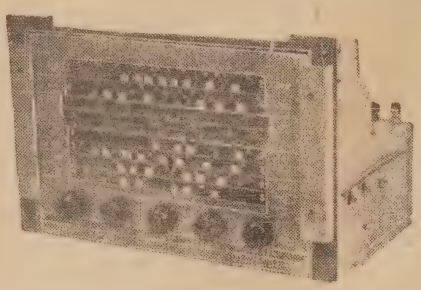

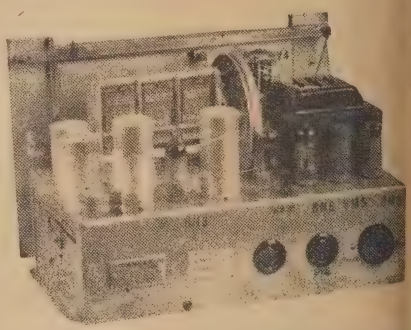

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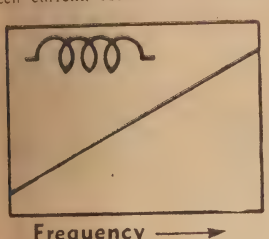
dome in series. However, we are
ng to get ahead of ourselves.
Coming back to figure 2a, there will
visibly be a movement of electrons
om the negative terminal of the bat-
ry through resistor R, through the
n and thence back to the positive
ry terminal.

DENTIAL DIFFERENCE

W have already learned that a re-
e by its very nature, offers a defi-
e opposition to the passage of an
ectric current.
e circuit may be compared in some
ects to a ferryboat turnstile. On one
e there is a crowd jostling to get
rough, while a thin file issues from
ther side. So it is with a resistor—
cumulation of electrons on one side
d fewer on the other. Look again
at last sentence.
What we really have is a potential
ference—or a voltage drop—across
resistor. The larger the electron flow
e higher the resistance value, the
ger is the voltage drop across the
sistor.
This observation is of fundamental
portance, and deserves plenty of
tention.
The exact mathematical relationship
tween current, resistance and voltage



gure 4. The reactance of a coil (or in-
uctor) increases with frequency.

t out in what is known as Ohm's
w:

$$E = I \times R \quad \ldots \quad (1)$$

ere E is in volts, I is in amps and
in ohms.
xplained in so many words, the for-
a simply means that the potential
ference developed across a resistor is
ual to the product of the current flow-
n through it (expressed in amps) and
h resistance (expressed in ohms).
hus, a current of 0.5 amp., flowing
ough a resistor of 6 ohms, would
velop a voltage drop of 3 volts across
h resistor.
ry it out for yourself with the for-
a!

TRANSPOSING FORMULA

By a simple mathematical "wangle",
mula (1) can be transposed into a
cond form:

$$I = E/R \quad (2)$$

Thus, if the voltage across a resistor
d/stated value is known accurately, for-
ula (2) makes it possible to calculate
h amount of current which is flowing
ough it.
For example, if a potential difference
say, 12 volts exists across the ter-
nals of a 4 ohm resistor, the current
wing through it would necessarily be
3 amperes.
Further transposition of formula (1)
es:

$$R = E / I \quad \ldots \quad (3)$$

If the voltage across a resistor is known, and the current flowing through it, it therefore is possible to calculate also the value of the resistor.

To elaborate further on these important and basic formulae would take up more space than is available, but the foregoing should give some idea of the essential relationship which exists between voltage, current and resistance.

It is important to note that all three formulas apply equally, whether one is concerned with direct or alternating current and potentials.

In figure 2a, the voltage across the lamp filament must inevitably be less than that of the battery by the voltage drop across the series resistor.

If the value of the resistor is small—just a few ohms—the lamp filament may still glow, but with reduced brilliance

With higher values of "R", the current flowing may be so limited that the filament will fail to glow at all unless the battery terminal voltage is greatly increased.

By having a variable resistor in place of "R" (figure 2b), it is possible to exercise control over the current flowing through the circuit and the voltage which is actually effective across the lamp. This is just one simple illustration of the actual effect of resistance in an electrical circuit.

In figure 3a, three separate resistors are shown connected in series—that is, connected end to end. The total resistance of the combination is simply the sum of their individual values.

SERIES CIRCUIT

Thus, if R1 is 1 megohm, R2 is .05 megohm and R3 is 7000 ohms, the total resistance of the combination would be 1,057,000 ohms or 1.057 megohms. Call to mind our explanation of the terms ohm and megohm, and check back on our addition.

In figure 3b, three resistors are shown connected in parellel—that is, side by side in an electrical sense. If the three occur in this fashion in an electrical circuit, they provide three possible paths for the current.

For a given electrical pressure (i.e., applied voltage), more electrons can move through the combination than could move through, say, just R5 on its own; in other words, the PARALLEL RESISTANCE of the combination is less than that of any individual resistor in it.

The general mathematical expression is:

$$\frac{1}{Rt} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} \ldots \text{etc.} \ldots (4)$$

in which Rt is the parelled resistance of the combination, R1, R2, R4, R5, etc., are individual resistors and all values are expressed in the same unit of resistance, the ohm or megohm.

Whether you can apply this formula immediately will depend on your familiarity with algebra.

As explained in a previous chapter, the passage of an electric current through a conductor is attended by considerable atomic agitation and a certain amount of the electrical energy is dissipated in the conductor as heat.

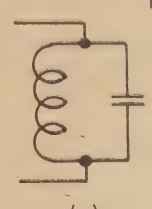
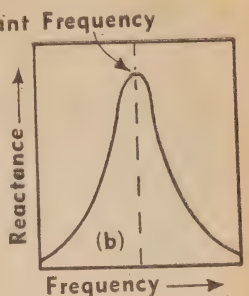


Figure 6. A parallel tuned circuit (a) and the variation of reactance (or impedance) with frequency. This is an important type of curve which tells a great deal about the characterstics of the circuit.



An extreme illustration is seen in the filament of an electric lamp, where the heat generated is so great as to cause the filament wire to glow brightly. The same heating effect is evident in resistors.

The electrical energy dissipated in a resistor is expressed in WATTS, being equal to the product of the voltage across the resistor and the current through it in amperes. That is,

$$W = E \times I \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

The above formula can be transposed in various ways and combined with the Ohm's law expressions given earlier, but it is not our intention here to pursue mathematical investigations.

Just remember that there is a definite limit to the current or voltage which any given resistor or combination of resistors can handle. For this reason, radio circuit designers often specify the minimum wattage rating required for certain resistors, as well as the resistance value.

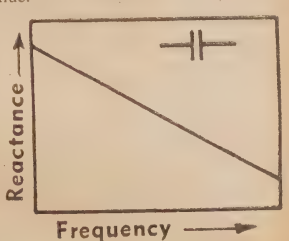


Figure 5. The reactance of a capacitor decreases with frequency.

If the constructor is careless enough to use too small a unit, the resultant heating effect may easily cause it to char and fail in service. So much then for resistors.

Because of their special characteristics, inductance coils — INDUCTORS, to be more correct — find frequent application in circuits involving alternating currents.

If necessary, they will carry direct current but offer marked opposition to the flow of AC; this much we have already seen.

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Cat. No. 4 101. This V.F.O. unit offers low cost, high stability, 3.5 Mc. —28 Mc. RF. generator that is accurately calibrated throughout each band and has simple band switching properties.

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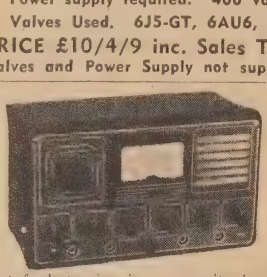

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e opposition to alternating current, is the reactance of an inductor, is ssed by the formula:

$$XL = 2\pi fL \ldots\ldots (6)$$

which reactance is in ohms, pi is 1 to 3.1416, f is the frequency of current in cycles per second, and the inductance in henries.

ithout worrying too much about the ula, one point is obvious, namely the reactance of any given inductor s with frequency. The higher the uency of a current, the greater the sition a given inductor offers to its age.

lotted graphically, the result is as vn in figure 4.

nagine an inductor connected into mplex circuit arrangement requiring carry a direct current and two alter- ng currents of different frequency. inductor would offer little opposi- to the direct, but definite and dif- nt degrees of opposition to the two rnating currents.

RIES INDUCTANCE

his discriminating effect of an in- tor is very widely utilised in radio i uits.

f two or more inductors are connect- in series, the total inductance value is al to the sum of their individual in- tances: this is exactly the same as h resistors.

n like manner also, the inductance ue of a number of parallel-connected uctors is less than that of any one of m, and the expression is similar to mula (4):

$$\frac{1}{Lt} = \frac{1}{L1} + \frac{1}{L2} + \frac{1}{L3} \ldots \text{etc.} \ldots (7)$$

Condensers — or may we call them acitors — are an exact counterpart their characteristics of inductors. Since the component parts of a capa- or are necessarily insulated from one ther, a capacitor cannot carry direct rent. However, because of the pheno- non of electron displacement, it will ry alternating current, although offer- some opposition to its passage.

This opposition, known as capacitive r ctance, is expressed in ohms and is gen by the formula:

$$XC = \frac{1}{2\pi fC} \ldots\ldots (8)$$

In which pi is equal to 3.1416, f is t frequency in cycles per second, and C is the capacitance in farads.

It is interesting to note that the react ce of a capacitor also is dependant on te frequency of the current flowing, but te relationship is just the reverse of tat which characterises an inductor. ith a capacitor, the higher the fre- uency of the current in the circuit, the wer is the opposition offered by the pacitor to its passage (Figure 5).

A capacitor in an electrical circuit us offers no path for the flow of rect current, but allows alternating cur- nt to flow through it with an ease de- ending on its own capacitance value, nd the frequency of the current. Here yet another discriminating effect, which widely utilised in radio receiver de- gn.

When capacitors are connected in arallel, the total capacitance is equal to the sum of their individual capacitance values. That is:

$$Ct = C1 + C2 + C3 \ldots \text{etc.} \ldots (9)$$

This is just the opposite effect to that stated for resistors and inductors. For condensers in series, we revert again to the familiar reciprocal expression:

$$\frac{1}{Ct} = \frac{1}{C1} + \frac{1}{C2} + \frac{1}{C3} \ldots \text{etc.} \ldots (10)$$

These expressions may be rather baffling to some, but don't worry overmuch about that. The whole purpose in this chapter is to give a general picture of how components behave and why they are used, rather than to get down to a precise mathematical basis.

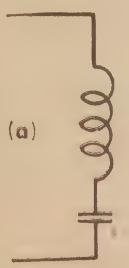


Figure 9. A series tuned circuit (a) and the variation of reactance with frequency (b). Circuits of this type are frequently used to absorb energy at a particular frequency, being then known as "trap" circuits. For normal tuning procedure the parallel connection is more commonly employed.

Circuit requirements often call for a combination of resistance and inductance, either in parallel or in series. The opposition to such a combination to the flow of alternating current is neither wholly resistive nor wholly inductive and is expressed instead as an IMPEDANCE of so many ohms.

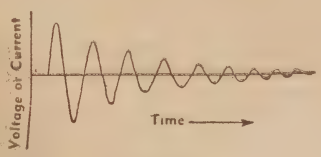


Figure 7. Illustrating the oscillatory nature of a tuned circuit.

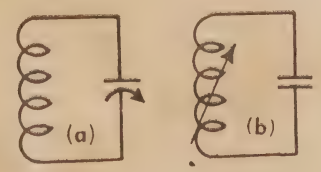


Figure 8. The resonant frequency of a tuned circuit can be varied by varying either the capacitance (a) or the inductance (b).

The same word "impedance" also applies in circuits involving a combination of resistance and capacitance.

Examination of the word impedance from a mathematical viewpoint is rather too involved for inclusion in this chapter, but the student is well advised to follow up the subject in other texts which choose to cover it in detail. But remember the term and remember also the effect of resistance, inductance and capacitance in an electrical circuit.

Resistance is a definite property, independant of frequency.

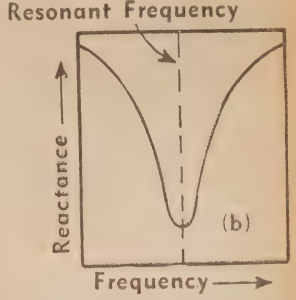
Inductive reactance depends on, and increases with frequency.

Capacitive reactance depends on, but varies inversely with frequency.

Inductors will carry direct current, but capacitors will not do so.

Circuits combining the above properties offer impedance to the flow of alternating current, the impedance depending on the frequency and the quantities involved.

At this juncture, it is necessary to mention a matter of vital importance, namely the combination of an inductor and a capacitor. To use more familiar terms, let us refer to a combination of a coil and a condenser.



We have seen that the reactance of a coil increases with frequency and that the reactance of a condenser decreases with frequency.

Referring then to figure 6a, it is obvious that, for any given value of inductance and capacitance, there must be a particular frequency at which the reactance values of the two are equal.

The frequency at which this occurs is commonly known as the RESONANT FREQUENCY, and the coil and condenser is said to be TUNED to it.

Because the two components are connected side by side (in the electrical sense) the combination is referred to as a PARALLEL TUNED circuit.

PHASE DIFFERENCE

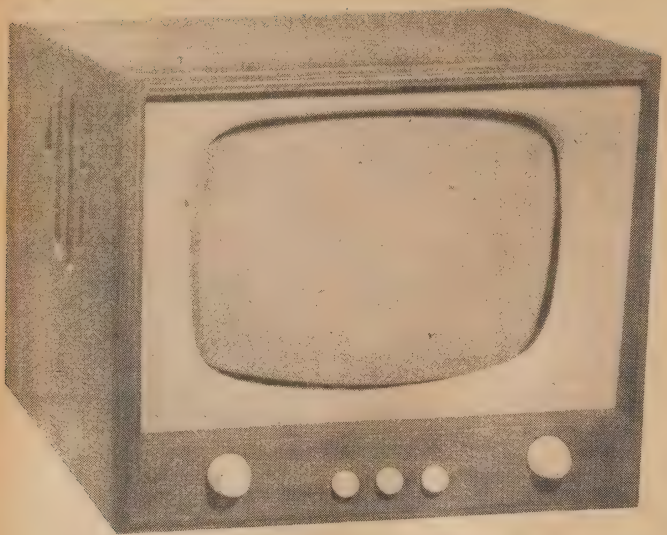
In previous chapters we have learned something of phase; that the current through an inductor lags behind the voltage but leads it through a capacitor.

It so happens that, at the resonant point of a tuned circuit, such as 6a, the phase difference in the two components cancel one another and the combination offers an opposition to the flow of current which is substantially resistive in nature.

The opposition reaches a maximum value at the resonant frequency for currents of frequency slightly higher or lower than this critical value, the opposition is less and is predominantly capacitive or inductive.

The relationship between frequency and reactance is shown graphically in figure 6b. Actually some resistive loss is present in all practical tuned circuits, so that it is strictly more accurate to

(Continued on Page 120)



A front view of the TV receiver. Controls L to R are Volume and Brightness (with on-off switch), Horizontal Hold, Vertical Hold, Contrast, Tuning fine and coarse.

- **Aluminized Picture Tube—17 inch**
- **Electrostatic focus**
- **Eighteen valves**
- **Pre-aligned IF strip**
- **Individual cabinet with mask and safety glass**
- **Eight-inch loudspeake**
- **Feedback audio system**
- **Flywheel time-base circuit**

OUR 17-inch TELEVISION SET

Exactly twelve months ago, in an Editorial, we asked the question, "Can a complete TV set be built in the home?". In this article we give you a practical and positive answer to that most pertinent question. What's more, we present here the description of a full-scale receiver which can, in fact, be built at home with no more facilities than are available to any well-informed radio enthusiast.

TO us, personally, this description ranks as something of a milestone, recalling other "historic" occasions—the first home-built "Ham" transmitter, the first superhet, the first tape recorder, to mention those which come immediately to mind.

All of these in turn involved their own particular problems, but a complete television receiver overshadows them as the most complex and the most ambitious radio project we've ever presented for home construction.

Be that as it may, based on the experience of the past few months, we are fully confident that any experienced enthusiast can build his own TV receiver and obtain from it first class results.

Nor is this mere supposition. From various quarters we have heard of amateurs and technicians who have already built successful receivers, ranging from 5-inch "disposals" units to the 22-valve Philips developmental circuit reprinted in May, 1956. In most cases, these readers have had to work out their own component and layout problems.

Their success is proof positive that, given adequate guidance along these lines, many more enthusiasts can build successfully their own full-scale receivers. In so doing, they stand to cut costs by at least one-third, and to gain invaluable experience in this (to us) new art.

Even as recently as twelve months ago, the whole TV position was very indefinite, both in regard to circuit trends and component supply. We summed up our attitude in these words:

"When we've found a satisfactory answer and seen to it that a complete kit of parts is available, then and only then will we encourage you to enter a shop, cheque in hand."

That time has come. Parts are anything but plentiful, but suppliers assure us that, allowing for a few minor hold-up they can now make complete kits available.

Twelve months ago, the types of picture tube to be use were still under discussion. A few advance samples wer available for manufacturers, but there were certainly none fo private buyers.

Deflection components were in the same category. Ther were no tuners, no IF strips, and very little in the way even o power supply equipment. To plan a successful home-con struction project against this background—or lack of it—wa next to impossible.

Then, some time before Christmas, a few definite clue began to filter through.

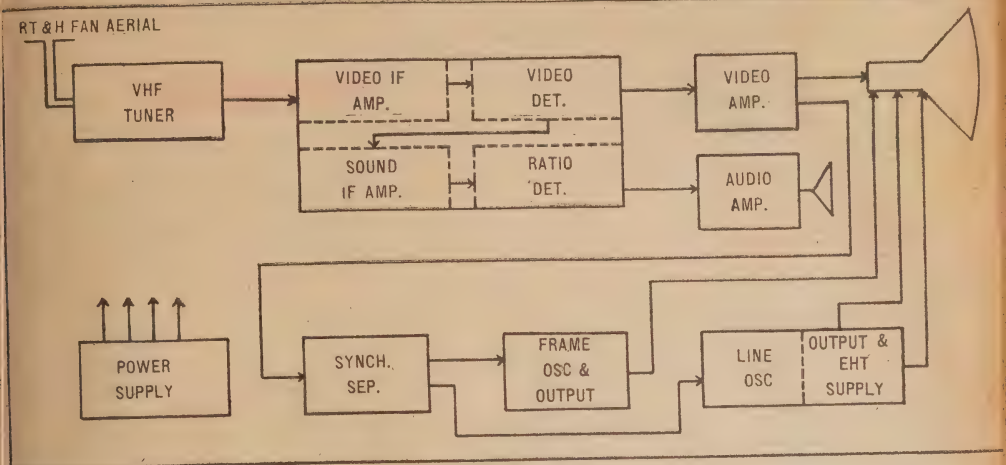
We received from a manufacturer an advance sample of pre-fabricated and pre-aligned IF strip, which he assured t would work well—when we got the rest of the equipment t go with it! From another came a low-flux power transforme and a filter choke.

Tuners were still unprocurable, but we could at least mak an intelligent guess as to shape, size and brands, from th types appearing in commercial receivers.

Then a picture tube came to hand and a set of deflectio components, with an assurance that others like them woul be released on to the market within a few months.

With these components available we were able to make start, not just to build a workable receiver, but to evolv methods of layout, construction and presentation which woul meet the peculiar needs of the home constructor.

We had to work out suitable means of mounting the ex pensive—and vulnerable—picture tube and the way chassis tube and cabinet would come together as a complete receiver



The television receiver breaks up into a series of units which are isolated here to help in understanding the operation of the se

What you see, this month, is the outcome of this planning and work. We hope you'll like it. We've had the satisfaction already of seeing the design adopted by other trade organisations, who were looking for a lead in the home construction field.

Nor have we any need to be modest about the end result. The picture and sound are as good as any we have yet seen on a local commercial receiver.

RARELY SEEN BETTER

The editor goes further. He says that he has rarely seen a better 17-inch picture anywhere in the world, thereby paying tribute not only to the set, but to the technical quality of local stations on good program material.

But enough of the preamble. It will take about three issues to give a reasonable description of the receiver.

This month we give a broad description of the circuit, so that you'll know immediately what the project involves. Enough constructional data will also be presented for you to make a start, perhaps getting to the point where you can listen to the programs and observe the video waveform on a CRO.

Next month, we plan to detail the picture circuits and possibly the EHT cage, leaving cabinet work and picture tube mounting till the third issue.

This last is a most important part of the whole project, which must be considered along with the basic design of the chassis. The picture tube is a heavy, bulky, expensive and vulnerable item, which cannot be left lying on the table as one would perchance leave a loudspeaker. It must be securely attached to the chassis or else hung in the cabinet and fed through appropriate cables.

It is sufficient to say at this stage, that we chose the latter alternative, so as to keep the tube most effectively out of harm's way, and also to protect onlookers from flying glass in the unlikely event of an accident with it.

It means extra cabinet work, but, by way of compensation, permits the use of a simple dish chassis, thereby saving cost and complication. But more of that, later.

In terms of electrical circuitry, the design of a television set is much less flexible than ordinary amplifiers and receivers. It is not practical merely to specify a circuit and then leave it to constructors to use any motley collection of major components which they may fancy or acquire.

Though designed basically to do the same job, different makes of deflection yoke may have quite dissimilar values of winding impedance. The same is true of the line and frame output transformers designed to work with them.

Wrongly matched components may or may not work at all or may produce deflection characteristics which particular width and linearity controls may not be able to correct.

Allied with the horizontal deflection circuit is the EH supply and EHT rectifier supply, which must suit the tub selected for use.

Again, blocking oscillator transformers intended for pa ticular valve types and circuitry may or may not opera with other valves and other circuit arrangements.

A further point is that great care has to be exercis in trying to combine circuitry and components from one sour with others taken from elsewhere. Questions of detect polarity, the number of video stages, AGC, DC lev contrast control, video peaking and so on, are all inter-relat and balanced one against the other in an optimum design. vary one without reference to the others can lead to all kin of difficulties.

Where it is possible to do so, we have chosen circ methods which do allow a maximum of flexibility. Elsewhe we have had to be quite specific in nominating particul brands and components.

The general sequence of stages throughout the receiv is quite conventional, but we have included a block schema diagram for those who may need some assistance in sorti things out. The main circuit diagram has also been subdivid to make it easier to follow.

BREAKS NEW GROUND

The discussion around it must necessarily be rath lengthy, because it is a large project and breaks new grou as far as RT and H. readers are concerned.

In designing the receiver, the first major decision centr around the type of picture tube to be used.

We decided that odd 12 and 14-inch types were too sm and too uncertain in their supply to be considered serious On the other hand, 21-inch types look to be too bulky and too expensive an initial home construction project, sides which valve manufacturers co give no indication as to when suppl of them were likely to be available the public.

That left the 17-inch as the obvi choice, leading to further questions to the particular type and brand.

The general tendency at the mom seems to be toward the use of pict tubes employing aluminised screens a electrostatic focus, and we reckoned that these would be g features to have. On this basis and the likely supply p tion, our ultimate choice fell to the 17HP4B, as specified in circuit.

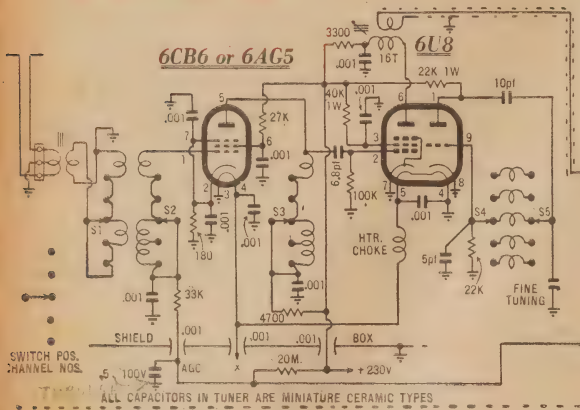
This type, which is currently used in many local overseas commercial receivers, has an excellent reputation reliability, color of screen and sharpness of focus over whole picture area.

by Neville Williams

CIRCUIT DIAGRAM OF 17-INCH TV RECEIVER WITH

For full dsoription of 5-Channel tuner see R. T. & H. for February 1957. A simple pentode tuner is suitable for good signal areas only. For poor signal areas use a "cascode" RF Amplifier or, for preference, a commercial tuning unit.

VHF MULTI-CHANNEL TUNER



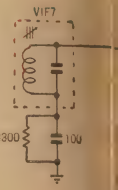
ALL CAPACITORS IN TUNER ARE MINIATURE CERAMIC TYPES

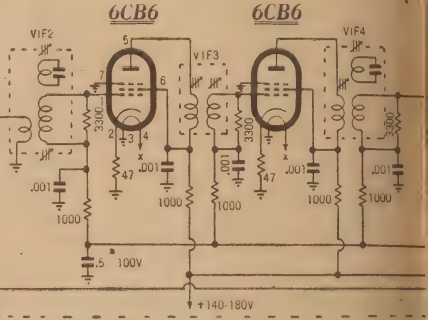
PRE-FABRICATED & PRE-ALIGNED VIDEO & SOUND IF STRIP

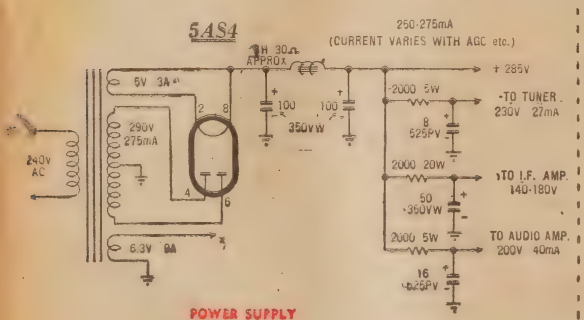
IF CHANNEL

Circuit shown is for a "Q-Plus" prefabricated and prealigned IFstrip, Mark 1. Mark 2 strip has a sound limiter stage for use in areas where interference is a particular problem. Q-Plus strips are available alternatively with 6BX6 valves and consequent slight circuit changes.

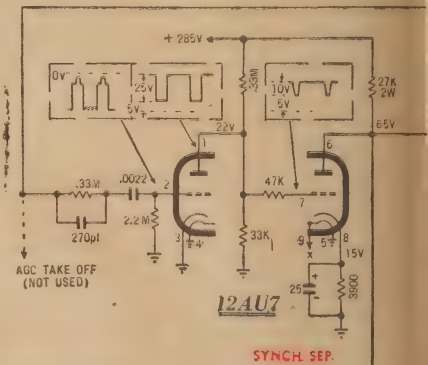
If desired, other makes of IF strip can be used or a home-built strip giving the requisite gain and bandpass characteristics.







POWER SUPPLY



SYNCH. SEP.

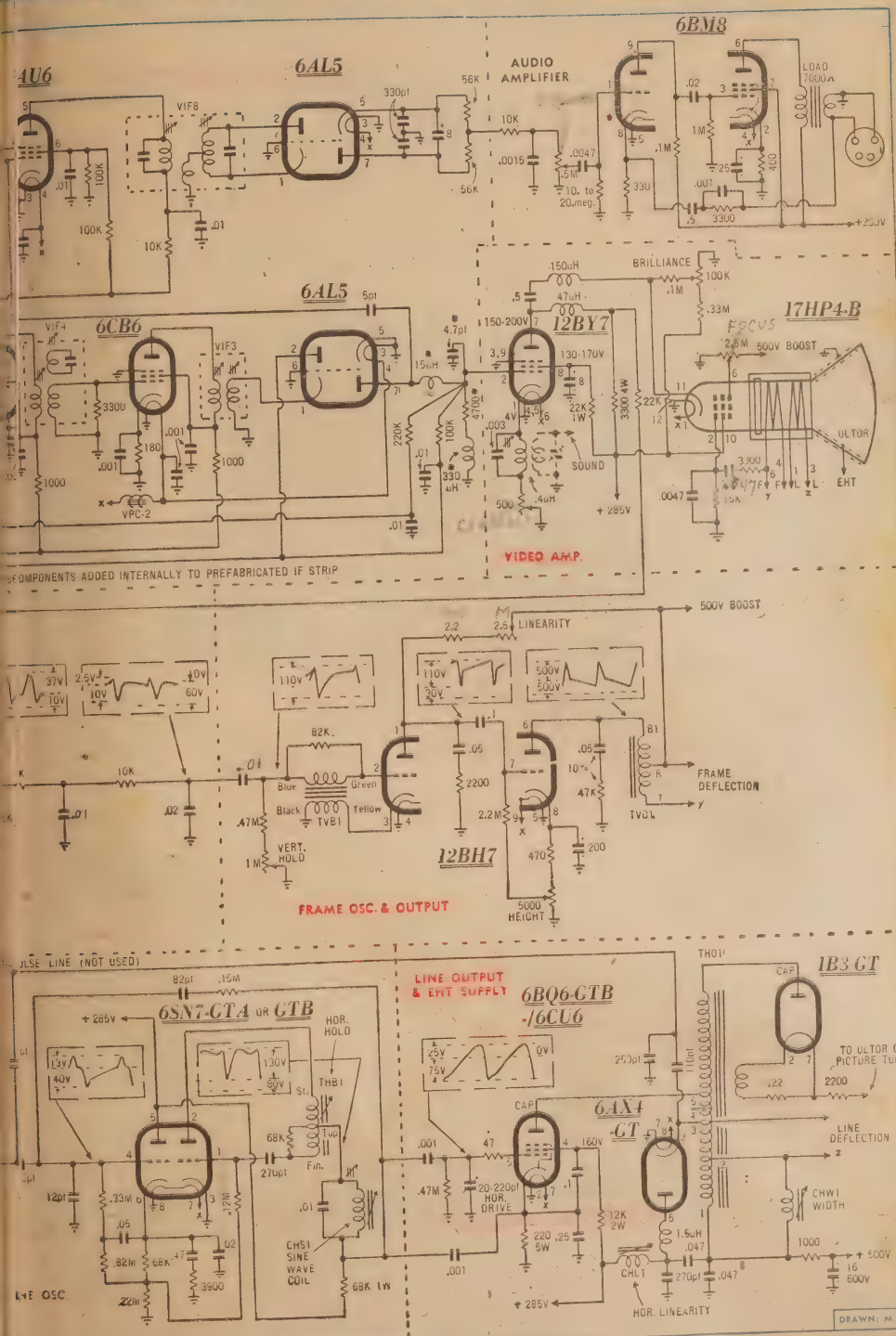
NOTES

1. ALL CAPACITOR VALUES ARE SHOWN IN MICROFARADS, UNLESS OTHERWISE MARKED.
2. ALL RESISTORS ARE HALF-WATT UNLESS OTHERWISE MARKED
3. VOLTAGES ARE AS MEASURED IN PROTOTYPE CHASSIS, USING STANDARD TOLERANCE NOT DESIGN CENTRE COMPONENTS.
4. ALL RESISTOR VALUES ARE SHOWN IN OHMS UNLESS OTHERWISE MARKED (M = MEG, K = x1000)

17-INCH TELEVISION RECEIVER

(PENTODE TUNER, SIMPLE AGC.)

IMPORTANT VOLTAGES, VALUES AND WAVE FORMS



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SPECIFICATION

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DISTORTION:	1% Max.
SENSITIVITY:	75 DBM
MAGNETIC PRINTING:	At least 60 DB below test signal after close contact
SIGNAL TO NOISE RATIO:	65 DB
ERASURE:	-60 DB
PLASTIC ELONGATION:	0.1%
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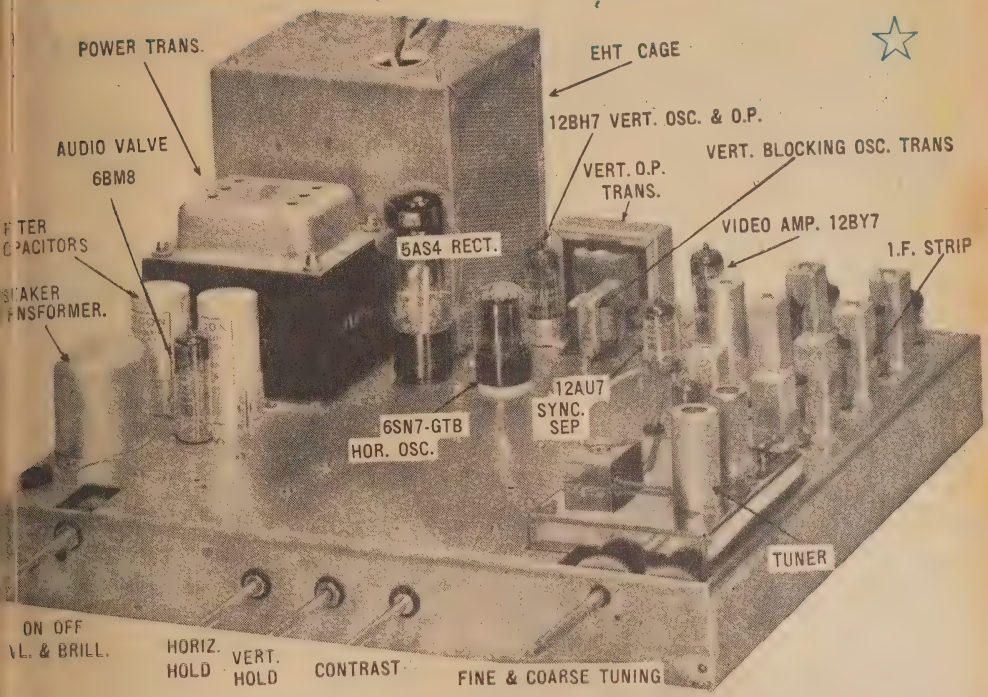
ENQUIRIES FROM RESELLERS INVITED

COMPONENTS MOUNTED ON SIMPLE DISH CHASSIS



Apart from the components in the EHT cage, everything is mounted on a simple dish chassis, which slides into the cabinet underneath the picture tube. For testing and alignment, the chassis sits firmly on the power transformer edge, with the normal cables making connection to the picture tube. It is only a couple of minutes work to remove the chassis from the cabinet or slip it back again.

t has a screen measuring approxi-mately 11 x 14in, with slightly curved sides and rounded corners. The flared portion of the glass has an external coating, which should be earthed, and an internal coating connecting to the high-voltage electrode or "Ultor". These two coatings together form a capacitor, with the glass as a dielectric, which serves to filter the supply from the EHT rectifier

OTHER POTENTIALS

Nominal EHT voltage for the 17HP4B is 16,000, which comes universally from a flyback type supply operating in conjunction with the line output transformer. This portion of the circuit will be discussed a little later.

In addition to the EHT, the 17HP4B requires about 300 volts on its No. 2 grid, from 0 to 350 volts on its No. 4 focus grid and a bias of up to minus 75 volts on its No. 1 grid.

The No. 2 grid presents no problem and simply connects in our circuit to the B-plus line which runs at about 285 volts.

The voltage on the No. 4 "focusing" grid is not at all critical and many receivers simply provide a wander-lead which is soldered permanently to earth, the B-plus line or to the B-plus boost voltage which is generally available from the damper diode.

We thought to go one better by returning the grid to a 2.2 meg tab-type potentiometer at the rear of the chassis, wired between earth and the B-plus boost voltage. This makes available a continuously variable focus voltage, as in many American receivers.

According to the manufacturers of the potentiometer, it is permissible to operate such a control with an applied voltage of this order but whether it is actually warranted is open to some doubt.

The focus of the tube proved to be so good over such a wide range of adjustment, that the focus lead could, in fact, have been soldered to the most appropriate voltage point. Whether this will be strictly true of every individual tube has yet to be demonstrated, however, and inclusion of the potentiometer is no great hardship.

The use of electrostatic focus avoids the necessity for a special focusing magnet or coil around the neck of the tube.

The No. 1 grid voltage (or bias) is obtained in our circuit by holding to grid at earth potential and applying a positive voltage to the cathode. This is obtained, in turn, from a 0.1 meg potentiometer forming part of a voltage divider between the B-plus line and earth.

This potentiometer is actually one section of a "tandem" control, operated from the front panel of the receiver by the "Brightness" knob. In effect, it controls the density of the electron beam striking the screen and corresponds to the "Intensity" control on an ordinary cathode-ray oscilloscope.

Other points about the picture tube circuitry will emerge as we progress.

Having selected a picture tube and provided for its basic supply potentials, our next major problem had to do with the choice of the deflection components and circuitry necessary to move the beam vertically and horizontally across the screen in the prescribed scanning pattern.

DEFLECTION CIRCUITS

Before one can hope to explain—or appreciate—the nature of this problem, as it affects the choice of components, it will be necessary to review the operation of this whole section of the receiver.

Normal practice is to provide a vertical (or "frame") oscillator and a horizontal (or "line") oscillator delivering respectively sawtooth voltages at approximately 50 and 15625 cps. These ultimately lock with the synchronising

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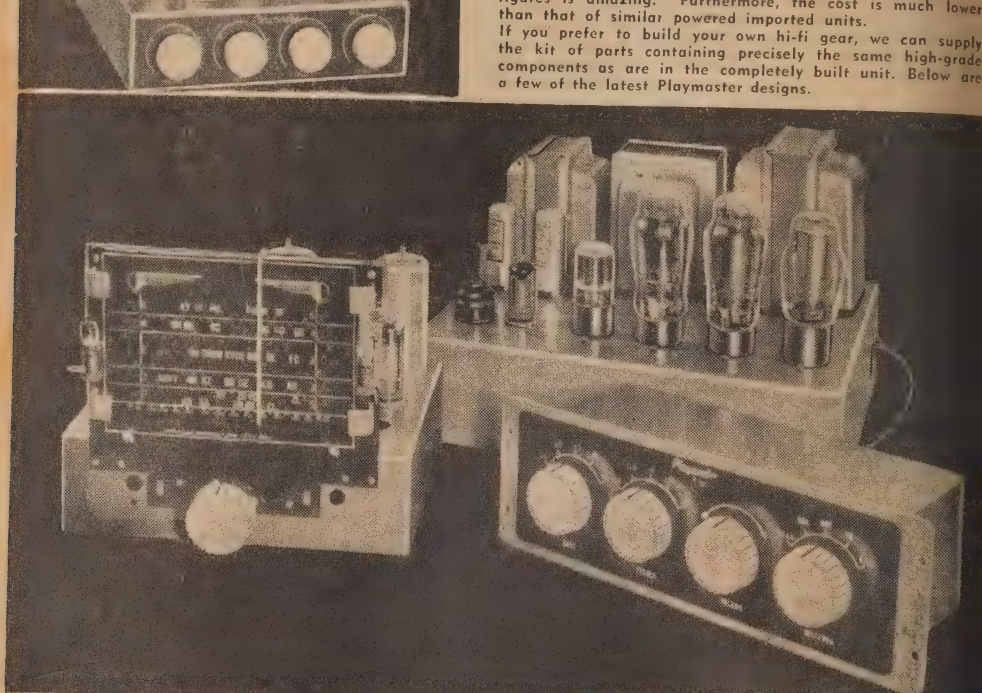

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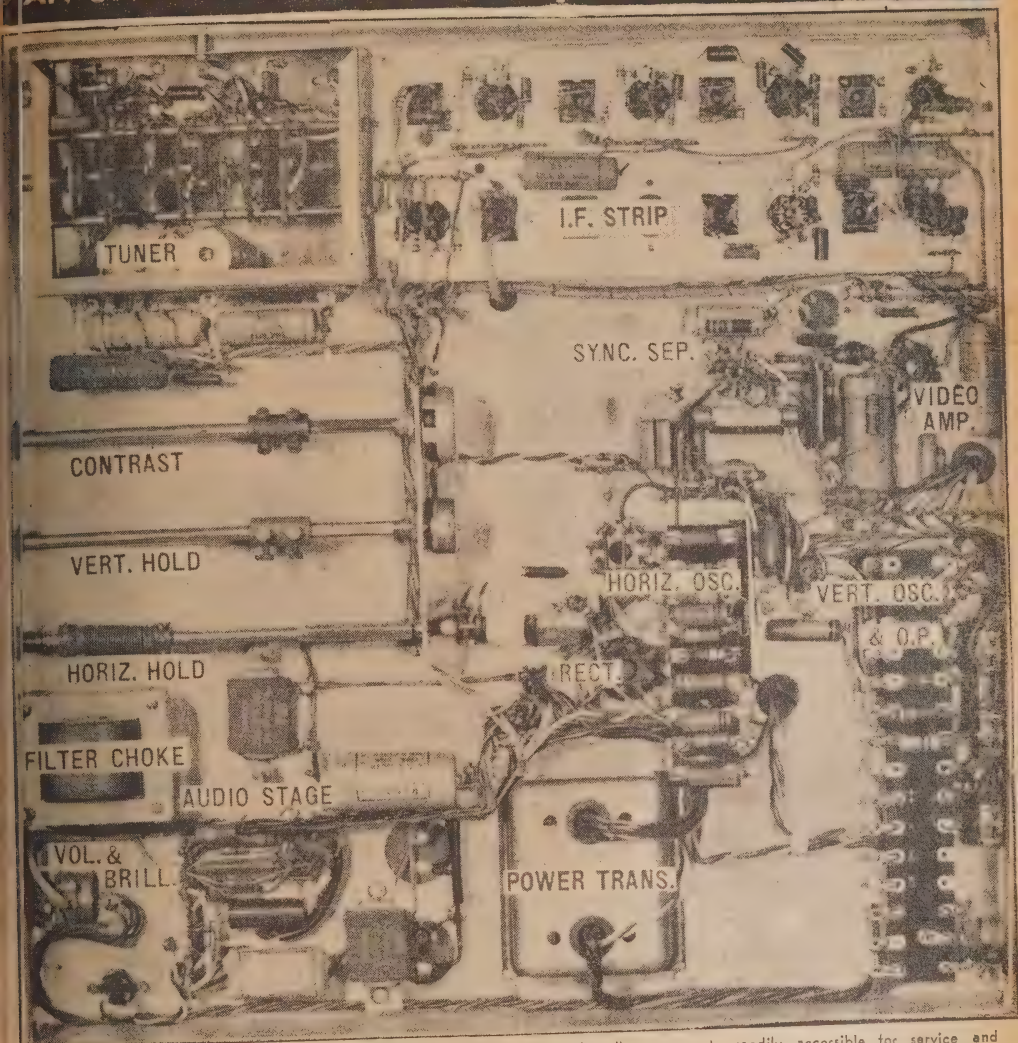
FULL RANGE FM TUNER

("R.T. & H." Jan., 1957) This smallest and most compact F.M. tuner imaginable, may be used with any of the Playmaster amplifiers and control units. Employs four 6AM6's and two crystal diode detectors which render it completely free of background noise. It covers the full audible range, and tuning embraces the complete F.M. Band. Designed for Australian conditions this tuner is suitable for reception of existing and future F.M. stations. Available in kit form, complete to the last nut and bolt (including ready made coils) or completely wired and tested.

PRICE: Kit of parts £17/8/6.
Wired and tested £26/18/6.

AN UNDERNEATH VIEW OF THE COMPLETED RECEIVER



Careful planning and systematic wiring has avoided crowding and made all components readily accessible for service and testing. The open space alongside the IF strip will accommodate a keyed AGC amplifier, should this be added at a later date.

ilses radiated by the television station. The output of the two oscillators is pplied in turn to frame and line out- it valves, which transcribe the sawtooth id-drive voltages to angular plate cur- nt wave-forms. These latter are com- unicated via frame and line output ansformers to the deflection coils in ie yoke around the neck of the tube.

The magnitude and wave-form of both eflection currents must be optimum if ie picture is just to fill the screen and ie scan is to be linear in both directions.

The frame output transformer, which andles a 50-cycle angular current wave- orm, is a conventional-looking com- onent rather like a loudspeaker trans- ormer. Apart from having suitable urrent and frequency characteristics, it ust have an input-output ratio which will suit the particular frame output valve and deflection yoke, with which it is to be used.

The line output transformer is unlike any component found in an ordinary broadcast receiver, being a large honeycomb winding on an equally large moulded iron-dust former and designed to handle angular waveforms at 15,625 cps.

It normally operates in circuit as an auto-transformer and must likewise provide adequate coupling and matching between the line output valve and yoke.

During the very brief line retrace period, the change in the magnetic field is very rapid and it develops a large counter, EMF across the transformer. This makes it necessary, among other things, to provide liberal insulation around the plate circuit of the line output valve.

In all modern receivers this tendency to produce a high-peak EMF on the retrace pulse is put to good use. The winding of the line output transformer is deliberately extended so that it will produce a peak voltage pulse equal to the nominal EHT voltage required by the picture tube.

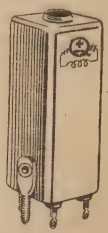
This pulse is applied through a rectifier to the picture tube Ultor, and therefore across the capacitance already mentioned between the inner and outer conducting layers on the glass envelope. Because of the high voltage and the low current (not more than 100 microamps) the storage effect of the capacitor is sufficient to convert the rectified 15,625-cycle pulses to virtually pure DC.

F.M.

"Q-PLUS" IF34 & IF35

10.7 M/cs F.M. I.F. TRANSFORMERS

Physical Size	⅜in x ¾in x 2in high
Mounting	23/32in square hole centre holes ¾in apart
Connections	P = Plate B+ = B+ G = Grid F = A.V.C.
I.F. Frequency	10.7 Mc/s
Inductance (uH)	Min. 8.0 — Max. 15.0
Q (In can) Unloaded at 10.7 Mc/s	Prim. 70 — Sec 70
Tuning C	15 pfd IF34 — 15 pfd IF35
Coupling factor (K'crit)	1.0 — 1.1



REMARKS

A wide band F.M. I.F Transformer using hi-stability tuning capacitors and polystyrene impregnated windings. Recommended in a 2 stage F.M. I.F. Channel (IF34 1st position, IF35 2nd position) for hi-quality F.M. Tuners

Specifications to change without notice.

R. W. STEANE & CO. PTY. LTD.
EASTERN PLACE, AUBURN, E.3, VICTORIA

F.M.

"Q-PLUS" IF36

10.7 M/cs F.M. RATIO DETECTOR TRANSFORMER

Physical Size	1⅝in dia x 2¼in high.
Mounting	1¼in dia, centre hole 1⅛in apart.
Connections	1 — diode anode 2 — tertiary out (audio) 3 — diode cathode 4 — plate 5 — Sec. tap & tertiary (do not use) 6 — B+
I.F. Frequency	10.7 Mc/s
Inductance (uH)	Min. — Max.
Prim.	5.4 — 9.7
Sec.	3.1 — 5.5
Tuning "C"	Prim. 15pfd — Sec. 50pfd
Q (In can) unloaded at 10.7 Mc/s	Prim. 70 — Sec. 50

REMARKS

A hi-performance 10.7 Mc/s ratio detector using hi-stability capacitors and polystyrene impregnated windings. Recommended for hi-quality F.M. Tuners

Specifications to change without notice.

R. W. STEANE & CO. PTY. LTD.
EASTERN PLACE, AUBURN, E.3, VICTORIA

PAGE 1 OF 2 T.V.

'Q-PLUS' MKI & MKII

T.V. VIDEO & SOUND I.F. STRIP

Physical Size
9¼in long
4in wide.
3½in depth.

Mounting cut out
3½in x 9¾in

Connections (tag strip)

Green	Audio output to 1st audio amplifier.
White	Video output to video amplifier via R.F filter & video correction choke/s
Blue	Filter supply 6.3V A.C.
Black	A.G.C. Circuits
Red	H.T. 135 — 150 V max

Gain: From link input to video detector output 75 db

Circuit Description: MKI Strip.
Video Section is of the 4 stage bandpass type using bifilar and over-coupled stages. The first three IF amplifiers (6CB6's) are compensated for input capacitance variation This is in the form of unbypassed cathode resistors.

Sound Section consists of 5.5 M/c sound pick up IF followed by a limiting amplifier and 5.5 M/c ratio detector of the balanced type

Circuit Description MK II Strip
As per MKI but has the addition of a limiting stage in the sound I.F Channel.

Specifications to change without notice.

R. W. STEANE & CO. PTY. LTD.
EASTERN PLACE, AUBURN, E.3 VICTORIA

PAGE 2 OF 2 T.V.

'Q-PLUS' MKI & MKII

T.V. VIDEO & SOUND I.F. STRIP

Alignment. Refer instruction sheets included with strip.

Band Width (video) Frequency (Mc/s) Response (Db relative to peak of curve.

37.5	Greater than	— 35db
36.0		— 6db
35.5		— 3db
33.0	Less than	— 3db
31.8		— 3db
30.5		— 26db
29	Greater than	— 30db

Band Width (sound): 5.5 Mc/s plus/minus 100 Kc/s max. deviation.

NOTE: Due to the size and detail of the circuit and alignment sheets, these can not be included in the data sheets. These sheets are normally supplied with the strip and can be obtained at 1/- per copy plus postage on application to R. W. Steane & Co. Pty. Ltd.

REMARKS

A hi-gain wide band video and sound I.F. channel giving excellent stability and performance. The unit is pre-tested, pre-aligned and sealed and when used with a suitable tuner, video amplifier and sound amplifier will give excellent results without any adjustment or re-alignment.

Specifications to change without notice.

R. W. STEANE & CO. PTY. LTD.
EASTERN PLACE, AUBURN, E.3, VICTORIA

ecause the circuitry requires both
ple and cathode of the EHT rectifier
to be above earth by the full voltage.
it filament supply could easily be a
n or problem. The need is met, in
mlern receivers, by operating the fila-
mit from line output energy picked
uj by a well insulated one or two-turn
cc. wound around the moulded iron
ce.

bviously enough, the EHT rectifier
ist use a low-voltage low-current fila-
nt, which fact renders it critical as
to operating temperature.

further point about the line output
uit is that the angular current wave-
fms passing through it initiate damped
illations or "ringing", which, in turn,
duce wrinkling effects in the final
ture.

AMPER DIODE

The ringing is controlled, in current
ign, by connecting a special diode
oss portion of the line output trans
mer so that it will rectify and dissi
e in its load circuit the surplus energy
tained in the ringing pattern.

It is only a matter of circuit arrange-
nt to have the rectified output from
is so-called "damper" diode superim-
sed — in the fashion of a voltage
ubler — on the B-plus voltage already
sent in the line output transformer.
ded together, the two produce a "B-
us boost" voltage of up to 500 and at
fficient current to allow it to be applied,
ry usefully, to the frame deflection
plifier.

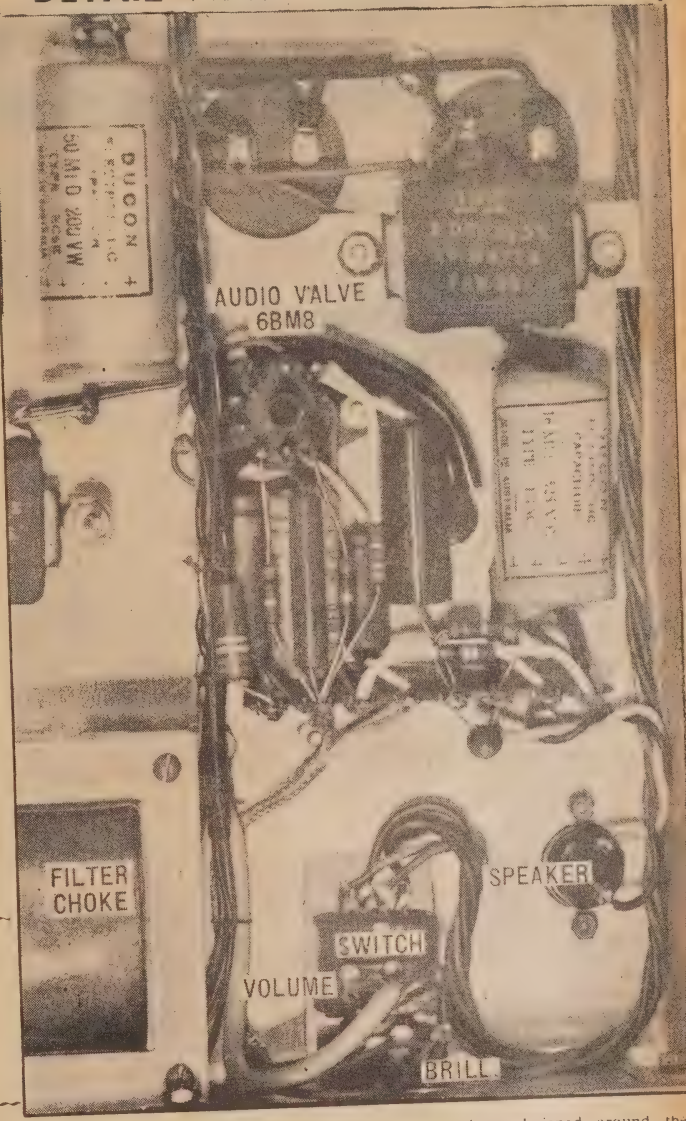
Very obviously, the whole of this
flection circuitry is interdependent and
major components must be completely
mpatable.

If they are not compatable the de-
ction beam angle may be too great
too small in either direction or the
nearity may be bad, leading to a severe-
distorted picture. These characteristics
ay not be capable of correction by the
rmal height, width and linearity ad-
stments.

The EHT rectifier may receive an un-
itable filament voltage leading to poor
eration or premature failure.

Depending on the characteristics of

DETAIL VIEW OF AUDIO SYSTEM



This photograph, almost full size, shows the corner of the chassis containing the audio amplifier and filtering. The complete audio wiring is centred around one valve socket and an 8-tag strip. The filter choke is at the bottom left, the two chassis-mounting 100mfd. electrolytics at the top.

ne line output valve the line transfor-
her and the loading imposed on it by
he yoke, the EHT voltage applied to
he Ultor may be too high or too low,
ffecting the deflection sensitivity of the
eam and confusing adjustment of the
eflection circuits.

The damper diode may wrongly load
he line output circuit or deliver an
nappropriate voltage to the B-plus boost
ircuit, thereby prejudicing operation of
he frame circuit.

Even if a normal picture is ultimately
btained, this cannot be taken as an
utomatic guarantee that valves are
perating within their maximum ratings.
There is usually little to spare in such
ircuits and, due to the difficulties of
measurement, it is very easy unwittingly
to transgress peak current or other ratings.

Valve manufacturers, appreciating this position, have in many cases made available deflection components and circuit data to suit their own preferred types. This is true of the 17HP4B, which is manufactured locally by the Amalgamated Wireless Valve Company.

As much as one can be sure of these things, the company claims that use of these components and data will ensure good deflection characteristics and within-rating operation of all associated valves.

To ignore this provision and be different for the sake of being so would seem a rather pointless attitude at this early stage. Accordingly, our prototype receiver has been designed around the circuit and deflection components released by the manufacturers along with the 17HP4B.

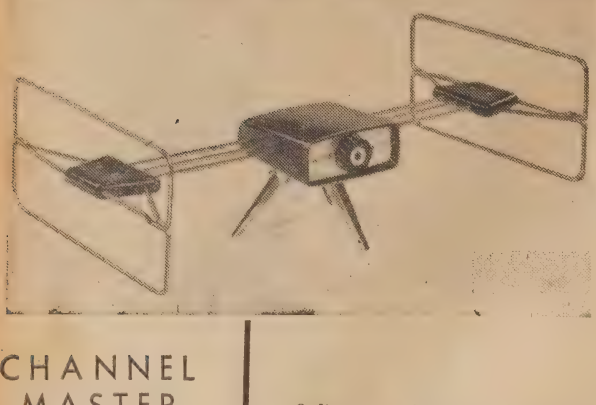
This does not mean that we are trying to foster a monopoly for the particular company. Long before this issue appeared on sale we had acquainted advertisers with the broad details of the new receiver.

Since it is likely to become a "standard" circuit for homebuilders — and remain so for some time — several advertisers have already expressed their intention of manufacturing deflection components expressly to suit it.

Logically, these will be electrically equivalent to those made available by the valve makers, giving you the oppo

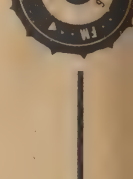
IT'S AVAILABLE NOW! The revolutionary

CHANNEL MASTER



"Showman" INDOOR TV AERIAL

with fabulous Metro-Dyne Tuning...



Ordinary switch-type aerials work by connecting various parts of the aerial into different combinations. METRO-DYNE tuning, on the other hand, is "variable inductance" tuning. It is the first system on the market (indoor or outdoor) in which a broad band aerial can be tuned to a specific channel so that it exhibits the band width characteristics of a single-channel yagi! This selectivity cuts down tremendously on "electronic noise" and interference. The system also incorporates an auto-transformer to maintain a constant 300ohm match on all channels.

The METRO-DYNE tuner is calibrated by channels. Just tune it with the TV set and it's ready to provide fine reception.

"Compressed Dipole"

Through ingenious design and an unusual application of the "end-loading" principle, Channel Master engineers were able to "lengthen" the SHOWMAN electrically and yet maintain minimal tip-to-tip dimensions physically—without sacrificing power! The "compressed dipole" is not only more attractive and more convenient but actually picks up far more TV signal than indoor aerials of the past.

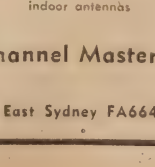
CHANNEL MASTER

The vital link between TV Set and Good Reception

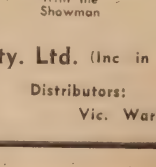
Channel Master is the world's largest manufacturer of TV aerials and accessories. Long before television came to Australia Channel Master survey teams had taken meteorological data and contour maps for all areas of N.S.W. and Victoria. These were sent to the famous Channel Master Laboratories in America and the result is that Channel Master TV aerials bring reception to fringe area towns where all else fails. 'Phone Channel Master for any data you require on TV reception. They have full data available now.

FIRST IN PREASSEMBLED AERIALS

ACTUALLY TUNES OUT "GHOSTS" AND "SNOW"! MORE EFFECTIVE THAN ANY OTHER INDOOR AERIAL!



With ordinary indoor antennas



With the Showman

Metropolitan areas, where indoor aerials are most frequently used, are often subject to the most severe "ghosting" problems. Only the SHOWMAN, with its sensational new Metro-Dyne tuning, can overcome this difficulty. You'll be amazed at the job it does on all kinds of interference. Test it for yourself!

Manufactured by: Channel Master Pty. Ltd. (Inc in Victoria) **752 Pittwater Rd., Brookvale**

Distributors:

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Vic. Warburton Franki (Melb.) Ltd., 380 Bourke St., MU977

ur[illegible]y of selecting other brands which
ns[illegible] perchance be better in some respects
r [illegible]heaper or more to your liking than
he originals.

[illegible]hat you must be certain about is
h[illegible] they are mechanically adaptable
n[illegible]electrically equivalent—not just parts
[illegible]hh happen to be known by the same
na[illegible].

[illegible]ter this rather lengthy discussion it
m[illegible] come as an anti-climax merely to
m[illegible]e passing mention of the deflection
[illegible]ut valves — half of a 12BH7 twin
[illegible]le for the frame circuit and a 6BQ6-
[illegible]] for the line circuit. We shall have
[illegible]e to say about them, however, when
[illegible]e tell you in a subsequent issue how
[illegible]o fire up the deflection circuits.

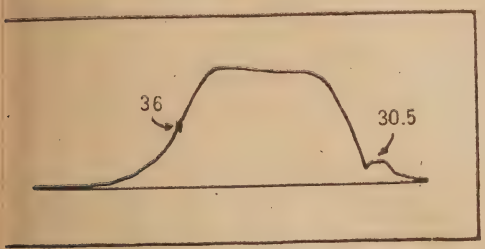
[illegible]CILLATOR COILS

[illegible]mong the components available
[illegible]m the AW Valve Co., are a line and
[illegible]ame oscillator coil looking respec-
[illegible]ly like a small audio transformer and
[illegible]oneycomb choke with variable iron
[illegible]. These two components, along with
[illegible]all "sine-wave coil" are intended for
[illegible]s with blocking oscillators to generate
[illegible]n fundamental 50-cycle and 15 Kc
[illegible]ooth waveforms, which drive the de-
[illegible]ion amplifiers.

[illegible]he principle of a blocking oscillator
[illegible]not be discussed at length here but
[illegible]xplained in most television textbooks.
[illegible]he basic idea is to have a valve
[illegible]ed as an oscillator, usually in a
[illegible]tly-coupled Hartley arrangement,
[illegible] that it tends to oscillate violently
[illegible]some frequency well above the out-
[illegible] frequency in which the designer is
[illegible]marily interested.

[illegible]he constants in the grid circuit are
[illegible]anged, however, so that grid current
[illegible] to the high frequency oscillation
[illegible]idly drives the grid negative and
[illegible]ses oscillation to cease.

[illegible]hus the voltage at the grid is the
[illegible]ombination of a highly damped high-
[illegible]requency wave train superimposed on a
[illegible]acitor charge-discharge curve. The



This sketch was traced freehand from the screen of the CRO during tests on the IF channel. It is not necessarily optimum for the strip but indicates that the passband can approach the ideal form.

[illegible]petition rate of this phenomenon, or
[illegible] "squegging" frequency as it used to
[illegible] called, is determined largely by the
[illegible]e constant of the components in the
[illegible]gd circuit.

The bursts of high frequency oscilla-
[illegible]n can be triggered and will readily
[illegible]k with external positive-going pulses,
[illegible]ovided these pulses occur at a slightly
[illegible]gher frequency than the natural period
[illegible] the grid circuit.

In a practical blocking oscillator, as
[illegible]r a television receiver, the angular
[illegible]ltage in the grid circuit is not used
[illegible]ectly. Instead, the plate current pulses
[illegible]e used to discharge or activate L, C
[illegible]d R components in the plate circuit,
[illegible]th carefully proportioned time con-
[illegible]ant or frequency characteristics.

It is from these components that the
[illegible]wtooth voltage is taken to drive the
[illegible]ame and line deflection amplifiers. In some cases, the blocking oscillator is used to drive a separate "discharge" tube which, in turn, drives the deflection amplifiers.

Blocking oscillators are used in many commercial receivers for both line and frame circuits.

Some designers alternatively prefer multivibrators in one or both positions on the general assumption, presumably, that they would rather use two valve elements in each oscillator, with resistors and capacitors, than one valve and a resonant circuit.

Others go virtually to the other extreme and for the line circuit, use an automatic frequency controlled sine-wave oscillator to activate the discharge circuits.

Arguments can be advanced in favor of all of these arrangements, or combinations of them. However, since the components and circuitry were available as part of the A. W. Valve Co. deflection kit, we decided to retain the blocking oscillator principle for both frame and line deflection.

If you refer to the circuit, therefore, you will see that the remaining half of the 12BH7 serves as the frame oscillator, with half of a 6SN7-GTB as a line oscillator.

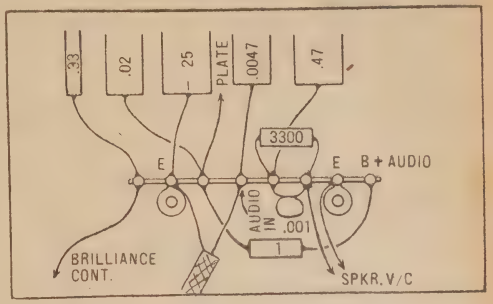
The first section of this same 6SN7-GTB is wired as a frequency control tube, using the so-called "Synchroguide" circuit, which is popular in the US, as well as in local commercial receivers.

A detailed explanation of this circuit must also be deferred, but its general function is to develop a DC voltage which depends on the relative time of occurence on the incoming line synch pulse and on a pulse received from the set's own line oscillator.

This control voltage is applied as a threshold to the blocking oscillator grid. Under equilibrium conditions, the oscillator frequency settles to the same figure as the incoming synch. pulses, any tendency to wander being corrected automatically by a variation of the control voltage.

Because of the time constants in the circuit, the threshold voltage cannot change abruptly, as with noise pulses, and the line oscillator is therefore largely immune to interference of this nature.

The components in the blocking oscillator and synchroguide circuit are interdependent and, in the original instance, were probably derived as much as anything by trial and error. The circuit works well in its present form, but uninformed efforts to "simplify" it are more likely than not to render it inoperative.



It is quite impractical to give a complete wiring diagram of the receiver but sketches like this should help you to duplicate the original layout. It shows the terminations on the tagstrip which serves the audio amplifier.

The same remarks apply for the blocking oscillator transformers and the sine-wave coil as for the other deflection components. If you don't buy them as a complete kit, you must make perfectly certain that they are suitable for this particular circuit.

Note that the Frame Hold Control is a potentiometer in the grid circuit of the frame blocking oscillator.. The Line Hold Control, on the other hand, is a slug which varies the natural resonance of the line oscillator transformer, having a reaction also on the blocking frequency.

The synchronising pulses for the frame and line oscillators come from a synch. separation circuit using both sections of a 12AU7 twin triode.

The first section operates with zero initial bias and very low plate voltage. It receives signal energy from the video amplifier through a network which emphasises the synch. pulses and diminishes the low frequency video information in between.

CUT-OFF BIAS

Due to the flow of grid current on signal peaks, the grid tends to bias itself toward plate current cut-off, and only the positive-going synch. pulses are effectively amplified, as will be evident from the waveform sketch. The picture information in between is largely suppressed.

At the plate of this triode, the synch. pulses appear as amplified negative-going signals, clipped by the limits of plate current cut-off and saturation.

They are fed directly to the grid of the second triode, where further amplification and clipping occurs, the pulses appearing at this point completely devoid of video information and, once again, positive-going in sense.

From the plate of the second triode, two capacitors forming a divider convey the pulses to the grid circuit of the line oscillator, where the leading edge provides the necessary synchronisation.

For the frame oscillator an integration circuit is necessary, which will eliminate the sharp lane pulses but build up a charge on the frame synch. group. This is accomplished by the two resistors and capacitors linking the synch. separator plate with the frame oscillator grid.

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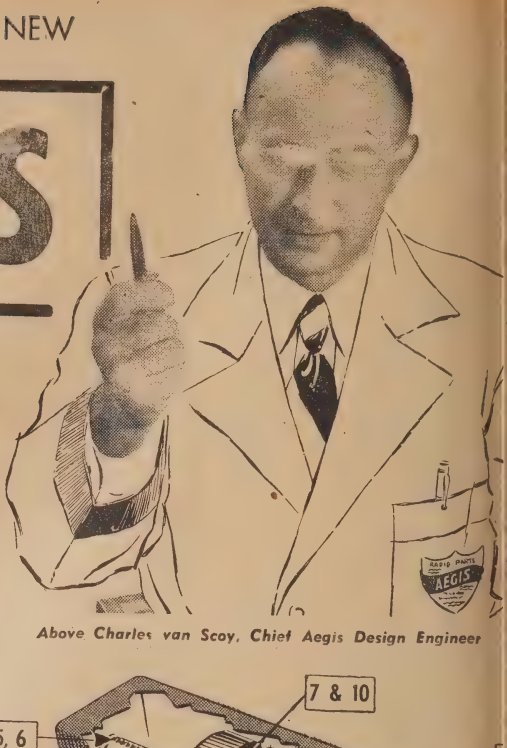
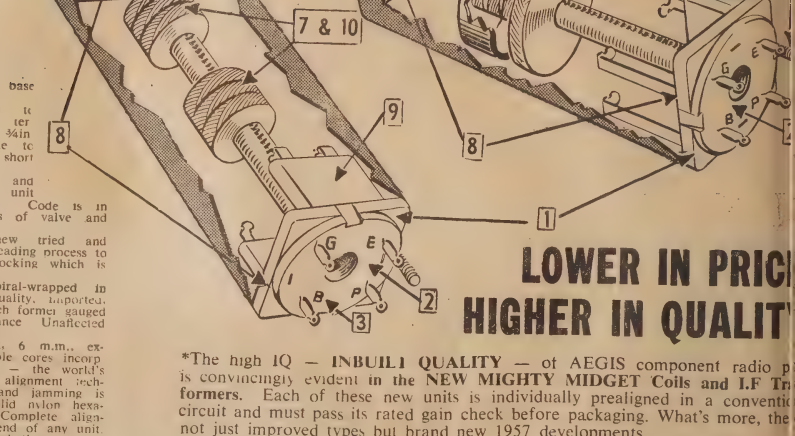


Above Charles van Scoy, Chief Aegis Design Engineer



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Th brings us, in our deliberately k)-front review of the circuit, to ideo amplifier stage.

Th is a single 12BY7 power pen- e) operating into a low resistance d) with series and shunt peaking k) in its output circuit to boost the h(video frequencies. Signals from etector, which are negative-going lse peaks, are positive-going at ideo amplifier plate, being there- e uitable for application to the pic- e lube cathode.

Capacitance coupling is used in this e) circuit, no attempt being made pserve the DC component.

In heory, this is undesirable, because nteracts overall changes in screen rnation, which might occur as a squence of the programme rial.

O SIGNIFICANT

In practice, with ordinary pro- rnes and under ordinary viewing nions the difference is not signifi- nt What is more, AC coupling is ed in a large proportion of com- erally-produced receivers.

As far as the homebuilder is con- nt, AC (or capacitance) coupling ners the video amplifier and picture on independent of one another in spect to DC operating conditions. It sopermits the use of a simple video ait or "Contrast" control in the tode circuit of the video amplifier thut affecting the brightness of the ure—as happens in some receivers.

The brightness and contrast controls e quite independent in the R.T. and . ircuit.

A sound trap is included in the tode circuit of the video amplifier, nd to 5.5Mc. Signal can be taken o this to the sound intercarrier IF nnel, if desired, either directly from e active side of the trap or through tned secondary winding.

We shall have more to say about e video amplifier in the next ar- el.

The remaining sections of the re- ei r-tuner—IF amplifier, audio sys- n and power supply—are the ones which we can take an immediate ctical interest.

It is suggested that you aim at com- leting these sections first, solving any ttendant problems before you go on o the picture circuits and cabinet work. It will also provide some immediate atisfaction in being able to listen to programmes, even if you can't see em.

SECTION AT A TIME

This is the way our own receiver was produced and the way in which one of our advertisers propose to make up their kits, should you want to buy the parts in "easy" instalments.

The IF strip in our own receiver is the "Q-Plus" Mark 1 unit, which is prefabricated and prealigned, ready to bolt into the chassis. For anyone who has no facilities for aligning IF cir- cuits, the obvious course is to buy such a strip.

Although we have since upset and misaligned the original unit for experi- mental reasons, it proved an excel-

TYPICAL PICTURE FROM SCREEN

This photograph, taken directly from the screen of the RT & H TV Receiver gives an excellent idea of the performance to be expected. For those interested, the photographic details are as follows: Camera, Rolleicord with supplementary lenses. Film, FP3 (ASA 80). Stop, f3.5. Time, 1/25 sec. Image a little brighter than normal.

lent response curve, as received. In fact, when coupled to a commercial tuner, it produced near-to-optimum signals without any alignment or testing whatever.

If you decide to use this—or any other prealigned IF strip—we suggest that you defer mounting it until the tuner, audio and power supply components are in position and as much other work as you can foresee has been done on the chassis. This will minimise the risk of vibrating the cores out of position.

We suggest also that you resist any temptation to "fiddle" blindly with the cores. Unless you know exactly what you are doing, and have the means to check it, chance fiddling will inevitably throw the whole channel hopelessly out of line, leaving you with distorted images or pictures with no sound or vice versa.

To avoid possible confusion in values, resistors in the television receiver circuit are given in ohms, except where otherwise stated. The suffix "K" indicates thousands of ohms, and "M" megohms. This is in line with current practice except for certain types of potentiometer, where the suffix "M" on the case is meant to indicate thousands of ohms.

The Q-Plus strip contains the complete video and intercarrier sound circuitry. It connects to the tuner through a low-impedance cable link and delivers video and audio from the far end. It is only necessary to bolt it into the chassis and provide heater, HT and AGC connections. This makes this portion of the receiver very easy indeed.

The overall size of the IF sub-chassis is 10½in x 4in. To mount it, a cut-out is required in the main chassis measuring 3¼in x 9 5/8in.

This space should be large enough, by the way, to take a video-only strip, with an intercarrier sound strip mounted separately behind it.

For those who want to save money —and who have access to alignment gear—it should be possible to duplicate the Q-Plus strip by buying the transformers as individual items and assembling the unit to the same physical pattern. With this possibility in mind, we have reproduced the complete circuit, as shown in the manufacturer's literature.

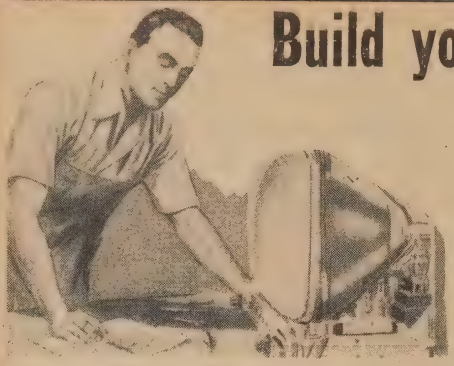
OTHER COMPONENTS

Alternatively, other manufacturers are offering IF components which you may prefer. Some are assembled prefab. strips, others are assembled but not wired: three are transformer kits which need to be built up into a unit and empty cans and formers on which you can wind your own.

It would even be possible, in the space available, to assemble an IF strip using the data and disposals-type valves suggested some months ago for the 5in receiver. This strip gives an excellent result electrically and we assembled all the necessary components to make sure that it would, in fact, replace the specified unit.

If fabricating your own strip, the important thing is to follow rigidly some design which looks to have been engineered properly in the first place. As we have pointed out in the "Television Course" an optimum curve can only be expected if due attention has been paid to matters such as AGC, regeneration, coupling, Q-factor, traps and so on.

With the picture displayed on a 17in tube, imperfection can become pain-



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D.C. CURRENT	275 mA
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PICTURE INDICATES LINEARITY

Here is another picture taken from the screen under the same conditions as the one on the previous page. Note detail and the straight lines, both vertical and horizontal.

ul obvious which escape notice in a
ir eceiver. The decision is up to you!
he tuner which is pictured on the
h sis is the RT & H 5-Channel pentode
u featured originally in the Feb-
r. 1957 issue. Since most readers
h ld have this issue on hand, it
h ld not be necessary here to repeat
th he constructional data. (For those
wh may have missed out, back num-
be are still available.)

brief, we developed and described
tuner in response to many requests
something that would be practical
above all, cheap and easy to build.
nce it had to be "sandwiched in"
ween other jobs, including work on
present receiver, we were not able
erform any detailed tests on it, nor
nine certain fine points which might
eivably have improved its perform-
. Accordingly, it was described in
article as a "developmental" project.

FICULT AREAS

e said it would work well in good
al areas but we warned readers not
expect too much in difficult areas
or with small aerial systems. We
ined about the limitation of a pen-
RF amplifier at 200Mc and sug-
ed the possible substitution of a
ode stage.

he position remains unaltered, be-
se we simply have not had the time
do any more work on the original
er. However, it has received a lot
pictures since February and dis-
ted any fears we might have had in
ard to tuning drift or switch failure.
appears to be completely free of
e troubles. Nor have any difficul-
arisen with regard to interference.
We would say, therefore, that it is
te a proposition for anyone in a good
al area, even in its present form.
soon as possible, we plan to experi-
nt with a cascode front end, which
uld boost its performance on the
h channels. This should not call
any major alteration, however.

Only one electrical change has been
de, namely to reduce by two the
mber of turns on the tuned output
nsformer.

f you have any qualms about build-
your own tuner, or if you live in a
ficult area, we can only suggest that
u purchase some commercial tuner
ich appeals to your liking and your
ket.

overloading of the tuner and IF channel on strong input signals. This subject is covered currently in the Television Course and separate explanation is not called for here.

Having considered the matter carefully, we decided in favor of simple AGC rather than the keyed variety. For all its good points, keyed AGC does require an extra valve and can be just one more complication in adjusting a new receiver.

Since very little is involved in the way of extra work, we suggest that you wire in a simple AGC circuit as the first step. Later if you feel inclined, and after the receiver has been put into service, the keyed AGC circuit can be added.

In the IF strip as supplied, the video detector circuit is incomplete. It requires the addition of a load resistor and a couple of peaking chokes, as shown in the circuit. For the time being, you need only wire a 4.7 K resistor between the video detector plate and earth.

We suggest, also, that you instal a 7-tag strip to the rear, alongside the IF channel, in the position shown in the underneath photograph. A lead from the video detector plate can run across to the rear lug on this strip, whence it will ultimately pass to the video amplifier grid.

From this point, wire a 0.22M resistor to the adjacent lug and an 0.1M to the lug beyond that. These two lugs should be bypassed with small .01 mfd capacitors to the earthed centre lug, leads running away to the AGC points supplying the IF strip and tuner.

From the end of the 0.1M resistor a further lead should loop across to the spare 6AL5 diode, which serves as an AGC clamp. The wiring to this diode may have to be modified in the IF strip without, however, disturbing the leads to the detector proper.

As will be apparent from the photograph, we mounted other tagstrips on the chassis immediately alongside the IF strip and tuner supply points.

AGC, heater and HT wiring was taken first to these tagstrips, then looped across to the tuner and IF supply points by short lengths of hookup. The arrangement facilitates installation or removal of these units for experimental purposes.

EXTRA CAPACITORS

The AGC lead to the IF strip runs via this tag point to the appropriate connection point. We found it desirable, however, to add an 0.5 mfd bypass to the AGC line, which we suggest you wire between the AGC point and earth within the strip.

A similar bypass is required for the tuner AGC but this can most conveniently be mounted to the tagstrip just outside the tuner. The same remarks apply to the 20 meg resistor which provides the AGC delay voltage.

The audio lead from the IF strip can be looped across to the tagstrip near the rear of the chassis which carries the AGC components. Two of the vacant lugs can be used to support the 10K filter resistor, the relevant leads and the de-emphasis bypass capacitor.

This latter, by the way, is only about half the value necessary for complete de-emphasis. We reckoned that the few extra decibels which remained unaccounted for, would usefully brighten the response from an inexpensive speaker.

From the tagstrip, an audio lead in low-capacitance mic. or coax cable carries the audio signal around the chassis to a tandem control near the audio amplifier.

This tandem control has a 0.1M unit at the front which will serve later as the

NEXT MONTH:

In the next issue we will continue this description by telling you, in detail, how to wire up the video and picture circuits, along with the EHT cage. Order your copy now, to avoid possible disappointment.

You will have to work out a suitable
thod of hanging it in the chassis and
lancing up the position of the knobs.
u will have to watch also clearance
ween valves and IF cans and the bulb
the picture tube, making your cabinet
inch or so higher, if necessary.

The "outrigger" input filter used with
MSP tuner may have to be pointed
t over the IF channel, this latter being
livered on pillars to go beneath it. Most
ers should fit into the allotted space.

Power requirements of most tuners
similar and there should be no dif-
ulty about providing the requisite
ater, HT and AGC voltage, exactly
for the R, T and H tuner.

An AGC circuit is required to prevent

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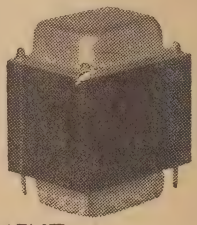

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- 1 5 x 2 x 5-bank Oak switch (Long shank, modified).
- 1 2-plate midget variable capacitor
- 2 1½-inch "Meccano" gear wheels.
- 1 Midget coil former in can (RCS or similar).
- 1 Noval socket with shield.
- 1 Miniature 7-pin socket with shield.
- 1 Ceramic stand-off pillar.
- 1 Heater choke
- 1 5pF ceramic (low drift type) capacitor.
- 1 6.8pF ceramic (low drift type).
- 1 10pF ceramic (low drift type).
- 8 .001 Hi-K ceramic.
- 4 .001 lead-through ceramic.
- 1 180 ohm ½ watt resistor.
- 1 3300 ohm ½ watt.
- 1 4700 ohm ½ watt.
- 1 22K ½ watt.
- 1 22K 1 watt.
- 1 27K 1 watt.
- 1 33K ½ watt.
- 1 40K 1 watt.
- 1 0.1meg. ½ watt.
- 1 6U8 valve, 1 6CB6 or 6AG5.
- 1 3-lug strip, nuts and bolts, winding wire for coils, short length of coax. cable.

VIDEO, AUDIO IF CHANNEL
- 1 Q-Plus Mark I or Mark II prefabricated and prealigned IF strip, or equivalent unit or components to fabricate same. (See Text).

AUDIO, POWER & AGC.
- 1 Chassis 17in x 17in x 2½in.
- 1 Power transformer 290V. 275 mA. 5V 3A. 6.3V 9A low radiation. Type PF1193 or similar.
- 1 Filter choke 3H 300 mA Type CF388 or similar.
- 1 Speaker transformer 7000 ohm pri. Sec. suit speaker.
- 1 Speaker. 8 in. Low leakage flux. See text
- 1 6BM8 valve.
- 1 5AS4 valve.
- 1 9 pin socket.
- 1 Octal socket.
- 1 Miniature 4 pin speaker socket and plug.
- 2 8 tag terminal strips.
- 1 7 tag terminal strip.
- 1 4 tag terminal strip.
- 2 100 mfd 350VW electrolytic capacitors.
- 1 25 mfd 40VP electrolytic.
- 1 16 mfd 525VP electrolytic.
- 1 8 mfd 525VP electrolytic.
- 3 .5 mfd 100V paper (or 0.47 mfd).
- 1 .02 mfd 400V paper.
- 2 .01 mfd 200V paper.
- 1 .0047mfd 400V paper.
- 1 .0015 mfd 400V mica or ceramic.
- 1 .001 mfd mica or ceramic.
- 1 tandem potentiometer with switch, front section 0.1 meg, rear .5 meg. with tapered element (audio gain).
- 1 20 meg (2 x 10 meg ½W).
- 1 10 meg ½ W.
- 1 1meg ½W.
- 1 .22 meg ½W.
- 2 .1 meg ½W.
- 1 .01 meg ½W.
- 1 4700 ohm ½W.
- 1 3300 ohm ½W.
- 2, 2000 ohm 5W.
- 1 400 ohm ½W.
- 1 330 ohm ½W.

...ess Control for the picture tube. ...ur section is a 0.5M audio volume ...r, backed by an off-on switch. ...shall have more to say about the ...hnical details of this control a little ...r.

...h audio circuitry is straightforward ...ould cause no difficulty for any- ...alified to tackle a project of this ...rude. We have included a sketch ...th original tagstrip wiring, merely ...e you the trouble of working ...e ing out for yourself.

...dio gain is adequate, without being ...and the use of overall feedback ...s that, within its power capabili- ...the amplifier will deliver a ...ghly acceptable signal. In prac- ...television sound channel is seldom ...d to anything but speech, sound ef- ...s or background music and it is ...t to justify anything more elaborate.

...ICE OF SPEAKER

...word of caution may be timely ...regarding the choice of speaker. ...u want to keep your TV receiver ...all dimensions, the speaker will ...matically have to be mounted close ...e picture tube and the magnetic ...d round it may seriously distort the ...n on the screen.

...e prime requirement, therefore, is ...e speaker having the lowest pos- ...leakage flux. Unfortunately, this ...n likely to be the case with wide- ...e speakers using high flux magnets. ...ettled for a Magnavox 8P2, which ...rd to meet the requirement very ...ll.

...If you have more expansive ideas ...o a loudspeaker system, then you ...d better start thinking about a cabinet ...ct which will bet the speaker as far ...ssible from the electron beam.

...e power supply in the R, T and H ...ver centres around a transformer ex- ...sly designed for television service. ...ese transformers commonly employ ...ch quality laminations than usual, ...d to help restrict the radiation field ...d to minimise temperature rise.

...he particular transformer is also ...ed with an external copper band ...short-circuit any residual field. These ...atures have presumably been effect- ...e, because there is not the slightest ...ace in the picture of hum modulation.

...AGE CAPACITORS

...Considering the high current drain, ...ering can only be achieved success- ...ully by using a relatively modest filter ...ke and very large filter capacitors, ...all previous standards. These are ...ed in a variety of capacitance and ...ge ratings but the manufacturer ...ested the ones specified in the cir- ...it as being likely to continue indefin- ...ely as "standard" lines.

...This basic filter gives adequate ...othing for the 285-volt supply to ...e video and deflection circuits.

...The tuner, IF channel and audio sys- ...m are decoupled, however, for ad- ...itional smoothing, for voltage drop and ...s precaution against interference and ...stability effects.

...The decoupling capacitors in the ...hotograph are larger than strictly ...eeded but they can be replaced with ...maller components in line with the ...oltage ratings specified on the circuit. ...The decoupling capacitors to the ...tuner and, in particular, the IF amplifier ...could possibly be reduced without ill ...effect. We played safe in the prototype receiver and used values which are commonly specified for these positions.

Because of the number of valves to be supplied, the total heater drain is substantial and the original transformer has a 9-amp winding using two stout parallel wires. Rather than try to anchor these initially to a socket, we terminated them on a tagstrip just near the rectifier.

HEATER WIRING

All heater wiring radiates from this point, being sub-divided into a number of branches to obviate unnecessary voltage drop. The original receiver was wired with twisted heater wires in case it should have been necessary to balance the heater winding about earth. This has not proved necessary, however, and our circuit simply shows one side of the winding earthed, in line with common practice in IF and tuning units.

The general layout of the chassis and wiring is clear enough from the coded photographs and should not require any great elaboration.

It was worked out with the greatest care, in an effort to achieve simplicity yet, at the same time, avoid major difficulties of either a mechanical or electrical nature. One of the gratifying features has been that no reconstruction or redesign whatever has been called for.

We suggest, therefore, that you think carefully before departing from this basic design, in case you should run into difficulties with hum in the picture, or instability, loss of frequency response or loss of interlace due to unforeseen interstage coupling.

In a project of this order, it is inevitable that individual problems will arise but they should not be of a major nature.

As mentioned earlier, we suggest you concentrate your initial efforts on getting the tuner, IF channel, audio system and power supply into operation. This will not only allow you to listen to the programs but will allow you to dismiss as tentatively finished one major section of the receiver.

Particularly would this apply if you are building your own IF strip and tuner. A part-empty chassis is vastly easier to handle and transport to where test gear might be than one which is cluttered with a mass of other components. Since the circuitry is complete to the video detector, it will be possible to carry out full video and audio alignment.

The one point on which you will have to make up your own mind is in regard to the length of the control spindles.

Those in the centre are no problem, because they can be extended to any length you might require and either terminated outside the cabinet or under an ornamental flap, as in some commercial receivers.

The concentric controls for the tuner and for Volume and Brightness aren't so easy, because they must be just the

(Continued on Page 121)

Let's Buy An Argument

The letter reproduced on the facing page ma y be a sincere epistle from a genuinely bewild ered man. Again, it could have been written by a well informed person who merely wanted to hand me an argument "on a plate". Either way it is worthy of comment.

by Neville Williams

SO that you'll know what I'm talking about, break off here and read the letter.

Okay?

You'll probably agree that it's one which had to be written by somebody, sometime.

Now, if I were connected with a Standards or Trade Investigation Group, and I wanted to investigate K.R.J.'s letter, my approach would be purely objective and statistical. It would involve the following steps:

THINGS TO DO

(1) Proceed to K.R.J.'s address and verify his observations about the number and types of aerial in question.

(2) Make similar observations elsewhere.

(3) Select a variety of aerials and erect them temporarily in various locations. Purpose would be to measure and record the order of signal level at the end of the transmission line on the three active TV channels and with the aerials orientated to various positions.

(4) Obtain a selection of commercial receivers and analyse their performance with signal input levels equivalent to those measured from the aerial systems.

By correlating these facts, I might be able to proffer certain opinions and conclusions which might clarify the matter.

Since I don't work for such a group, however, and since writing "Argument" is only one of several duties, my approach to the subject must be on a much more general and speculative basis.

I hope it comes close to the truth, but, in any case, it isn't bad material if anyone should want to "buy an argument".

In the first place, and without debating whether K.R.J. is guilty of overstatement, I have seen exactly similar installations.

I have seen elaborate aerials erected in what are obvious vantage points, in clear line of sight to the station uncomplicated by any apparent ne tive prominences. I have seen aerials pointing in a variety of direc

What's more, I'd be very surpri the explanation had anything to do the signal pick-up qualities of the boom. The reason could, per ch be much more commonplace.

Television is still sufficient novelty in the community for it something of a distinction to own

However, it would look rather ob to lay claim to such distinction by h a notice on the gate like "Telev Installed Inside". What more na than to have a nice big aerial ins above the gable for all the neighbor to see?

ONE REASON

I'm not suggesting that everyone t this way, but it certainly is one re why more and bigger aerials are en than might strictly be necessary.

Then, again, there are the folk quite genuinely reason that, since are spending so much on a set, may as well buy an expensive aeri well. The fact that it could be n bility is not immediately obvious.

Now, don't get me wrongly. T are plenty of cases where a good system is desirable or even essential can mean the difference betwee strong signal or a weak one. It provide a measure of immunity from terference and protection from "gh phenomena.

Hence the R. T and H Fan A described some months back.

But here's the point:

For one reason and another m elaborate, expensive aerials have erected, purely as a matter of cours sites from which the transmitting m can clearly be seen. The order of nal which they pipe down to the rece must be enormous.

With some receivers it mightn't ter a great deal, because their autom gain control system is capable of co tering it.

ADEQUATE AGC?

But not all receivers have elabo AGC systems. I'd be very surpri frankly, if, in the effort of evolv adapting and simplifying circuit desi every model has emerged with a c pletely adequate AGC system.

Where such is not the case, high-l input signals from too-large aerials close to the transmitter may easily

verload and a variety of conse-
ndesirable effects.
I ven't yet personally had the op-
uty to observe all these aforesaid
ct but I understand that they in-
luch things as sound in the pic-
, icture in the sound, and grossly
o d tone values, even to the point
inge reversal.
t he time of installation, the dealer
v may not have known the limita-
s of the particular model receiver
c the customer fancied.
f nay or may not have known what
x ct from the receiver, with a par-
l a aerial at a particular site.

ER AERIAL?

e nay or may not have been will-
i talk the customer into buying a
a r aerial, when the opportunity was
n o sell an expensive one.
y when the deal was closed, the
a tion made—and the set exhibited
r d characteristics—what could the
le do to correct the situation?
e rt to a smaller aerial, after all,
a loss pad in the transmission line,
m ely turn the array around to one
s ?
V aps something like this last has
p ed over in K.R.J.'s district. Or
I overstating the case?
T e are other circumstances, of
ir which can cause aerials to end
a rather odd angles for best picture
p on. Generally, these have to do
h ghost" phenomena.
f levision aerials were strictly uni-
x onal devices the position would
r ch less ambiguous. The aerial
u simply be pointed at the station
a ource of strong reflected signals
l erything else rejected.
B multiband television aerial sys-
a aren't unidirectional devices. Be-
s of their own compromise charac-
s s, signal pickup on the transmis-
n ine or the influence of surround-
i uctures, they exhibit all kinds of
e and loops.

DI ANGLE

n many cases, the best picture is not
e obtained by pointing the aerial
a t at the station. It may often
c rather, when a gap in the polar
g m is directed toward an interfer-
e ource.
W at is more, these gaps in the polar
g m can vary with the Channel, the
e of aerial and with the installation.
t t the end result can be quite ran-
n
I s is, rather than the overload theory,
a xplanation of K.R.J.'s letter? Or
is a combination of both? The ball
is your court.
A will be apparent from the descrip-
n lsewhere in the issue, I have burn-
a good deal of midnight oil recently
d velop and present the R, T and H
i h Television Receiver.
I ave also spent a certain amount of
n gazing at test patterns, assessing the
u ness of circles, the straightness of
e s and so on.
I the process, I've been much in
d at times as to who was doing
w —whether I was supposed to be ad-
ti g a receiver or some other fellow
fi likewise to a transmitter.
I saying anything, of course, I am
st ng out my proverbial neck but, after
l what are these columns for? I
simply raise the question: Are all the funny patterns seen on television screens attributable to receivers or could the stations be at fault, even occasionally?

One afternoon recently, eschewing the use of a mirror, I spent several minutes dodging back and forth around the receiver, wiggling the magnets and controls to get a test pattern framed exactly in the mask. As television goes, it was a precision job.

A few moments later the pattern changed, or I changed to another channel—I forget which now—and the test card was a full inch over one way. Likewise for other patterns.

In the process of similar observations, I sat back to admire a circle, about half the height of the screen, being radiated by a particular station.

Ah, eet vas bee-outiful!

But, alas and alack, a similar circle from the station next door was considerably deflated around the bottom.

But the one that intrigued me most of all was the circle which had a couple of little wiggles on either side. I twiddled the Line Hold control, then the core of the horizontal sine wave coil, without improving matters, then sat down to puzzle and gaze—or vice versa.

A few moments later, the test pattern faded from the screen but, as it did so, the wiggles straightened themselves out.

Trouble in the set?

Who am I to say?

NO SIGN OF TROUBLE

I only know that, in the program which followed immediately afterwards, there was no sign of similar kinks in vertical lines at the same points on the screen.

Rather intrigued by all this, I rang a friend who has reason to handle a lot more receivers than I do.

"Test patterns," he said.

"They're not always centred and the circles aren't always the same shape.

"In fact, I've never seen a perfect circle from Channel . . ."

I've every confidence in this friend's observations and he's well aware of linearity problems in receiver time bases. In fact, he lives among them.

We've often joked about receivers which present a particular test pattern as a circle inside a pear.

Apparently I was not alone in my observations.

The most intriguing of all, however, occurred during the recent weekend.

NOT SYNCHRONISED?

All three Sydney stations were on the air with test patterns ready for their Saturday afternoon sport programs. I switched from one to the other to observe linearity, etc., and make any necessary adjustments.

Suddenly the pattern from one station disappeared in a blur which was exactly similar to loss of line synch. I screwed this and screwed that to no effect, being puzzled meanwhile that the other station patterns were normal.

Could it be the station?

A few moments later the pattern reappeared of its own accord, to be followed by the regular program. That left me to restore the adjustments which I'd compromised trying to lock the missing pattern.

The following evening I saw the same pattern again from the same station. It occurred just after close-down for about half a minute. Then the channel went dead.

What's the explanation? Loss of synch in the station's equipment, deletion of synch pulses or what? I don't know, but the result on the viewing screen is rather disturbing.

This morning, a few minutes before writing these notes, we were looking at the signal from a transmitter, unmodulated except for a most elaborate "watermark" effect horizontally across the centre of the screen. We were inclined

WANTS MORE BOOM, LESS AERIAL

I have hesitated in writing this letter to you, for although there are times when I quite enjoy an argument, on this particular subject I am a novice.

Like a lot of people who cannot afford television, at present, I have been happily contemplating the time when I will. Consequently, I have been interested to note the particular aerials being erected in my district in an effort to help me reach a decision as to what aerial I will eventually instal.

I am fortunate in a way that from my street it is possible to see the transmitting aerials and so get an idea in which direction the receiving aerial should face. As well as this I should explain that there are no obvious obstructions, hills, high chimneys etc., to cause interference apart from occasional planes flying overhead.

However, with all these apparent advantages, I have noted that a big percentage of aerials have been installed facing at right angles to the transmitters. I puzzled over this for weeks before a possible solution came to me and it is about this solution I am submitting my argument.

Briefly it is this. The boom which supports the aerial is acting as a superior aerial to the aerial itself and the more times I drive around observing aerials, the more I believe this to be the case.

I would like to stress here that it is not the case of one particular make of aerial which is affected but many makes. I would also like to state that there are even cases of adjoining houses one with the aerial facing in what I believe to be the right direction and the other at 90 degrees to it.

Also, in not one case have I seen the aerial on an electrical shop facing other than in the right direction.

To me it all seems to add up to a conclusion that all that apparently is needed (at least in my district) is a mast suporting a boom of anything approx. 2 feet to 6 feet and on this point I will leave you to (I hope) argue it out.

Yours faithfully, K.R.J.

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PICK-UPS continued

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me the receiver, except for the fact
he mark was an exaggeration of a
r effect that other viewers had
oned as having seen across this
station's regular programs.
What's more, there was evidence of
tation engineers playing technical
, because, at one stage, they re-
d the interframe blanking pulses.
mightn't have noticed this last had
been that we had the frame cir-
out of synch watching the hammer-
pattern as it rolled across the
.

a good thing for stations to radiate
atterns and to see that everything
n the dot" before the program
iences. The trouble is, however,
he viewer can never be quite sure
er the test pattern is actually op-
or only supposed to be, or is
going adjustment while being radi-

haps the sound channel and an
ss tape could be pressed into ser-
o intone:
on't look now, viewers, click; don't
now, viewers, click; don't look
viewers, click . . . etc."

I seem to be over-critical may I
ensate in part by paying tribute to
oduction and camera work now
ning evident in locally-produced
ams. The awkward moments are
ning progressively more rare and
a few times I find myself thinking,
ms borrowed from a certain Holly-
actor, "That's a picture."

d before leaving the subject of tele-
for another month, I must very
ly seek your assistance.

NAMILIAR MATTERS

Looking over the advertisements for
mercial receivers, I have discovered
terms and inferences which do
appear in any textbook I have yet
.

This is a very serious matter, because
e Technical Editor and staff of a
zine such as ours should know such
ings. In fact, they're paid to know
.

What could I say, for example, if
one were to write in, postal note
call, for an explanation of the prin-
, behind "balanced fidelity"?

, yet again, for the circuit of a
ver to give contramatic pictures?

meone might even ask whether or
he new RT & H receiver produced
ep image.

wouldn't know the answer.

en, again, a reader in the role of
n" might request guidance as to
hh was the best feature to have in a
ver, widescope or safeTVision?

our ignorance, we'd have to dis-
the question by changing it into,
w does grid bias work?"

nd last, but not least, some very
ankerous person might address a
r to these columns and suggest that
-degree deflection tube doesn't really
a wider field of view than a 70-
ee tube.

can't find any textbook which says
es, but you never know, do you?

h, yes, I nearly forgot.

rather gathered from an advertise-
t over the air the other evening that
rtain brand of television receiver of-
d a true 3D picture.

Without wishing to start a still further argument on this subject, I'd like to know how they do it, with one channel, one transmitter and a single viewing screen.

I can only suggest that the engineering genius behind this "achievement" is wasting his time designing television receivers in Australia. He should catch the next plane to Hollywood where, I am sure, he could sell his method to the film magnates for millions of bucks.

A FEW THINGS

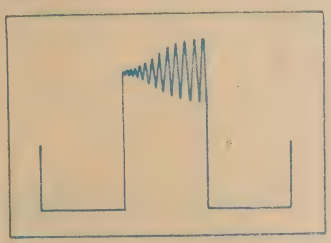
Either that, or he should take the advertising copywriter aside and tell him a few things.

Now for a complete change of subject.

"Motorboating" in audio amplifiers is usually ascribed to feedback from output to input via the power supply circuitry.

Pulses of current drawn by the output stage cause a slight fluctuation of voltage on the HT line. This may reach an early grid by way of the preceding plate circuit and be amplified, as would an ordinary signal.

If the phase relationships happen to be conducive, the amplified pulse may reach the output stage and augment the



When a particular amplifier developed this unbalanced HF oscillation at near full output, it produced an effect which might easily have been mistaken for "motorboating".

current fluctuation which originally produced it. In other words, a regenerative effect becomes apparent.

In a mild degree, such regeneration may merely promote damped oscillation, evident as a tendency for the speaker cone to flop back and forth on occasions when excited by high level signals.

In a more extreme case, the regeneration produces sustained and active feedback, which is evident as the familiar motorboating effect.

The violence of the motorboating depends largely on the degree of feedback and the power of the amplifier. The frequency has to do with the time constants of the power supply filter circuits which affect, in turn, the phase of the unwanted feedback voltage.

HF OSCILLATION

There is nothing new in all this.

At times, however, I have noticed that motorboating has been related to an amplifier's tendency to instability in the supersonic region. I have said as much, without thinking a great deal about it.

During the month, we had occasion to run the rule over a home-constructed amplifier, built originally in England and using an English output transformer. I mention this point deliberately, because folk sometimes get the idea that wide-range amplifier troubles are peculiar to the southern hemisphere, that all would be well if only they could get their hands on "good" imported transformers. Stuff and nonsense!

The problems of inductance, capacitance, coupling and balance are just as fundamental overseas as they are here and I have never seen any practical examples which might lead me to believe otherwise.

However, to get back to the story. This particular amplifier had performed well enough over the audible range, with reasonable distortion, power handling and frequency characteristics.

A check over the supersonic range, however, revealed a very high peak at about 150 Kc, evident because the amplifier had no phasing capacitor across the feedback resistor.

Before even switching to square-wave input, we knew what to expect — or we thought we did.

With square-wave input at moderate levels, the normal ringing pattern appeared, with damped oscillations spread well along the flat top. These disappeared, substantially, with the optimum value of phasing capacitor across the feedback resistor.

The thing that intrigued us was the behavior of the amplifier with a wrong value of phasing capacitor (or none at all) and near maximum output. On square waves it had the general appearance, as illustrated, with a solid block of oscillation building up on one side only of the output wave form.

SHAPE VARIED

Its shape and amplitude was not constant, however, as might be inferred from the sketch. Rather did it tend to pulse at a slow rate. As it did so, the whole position of the curve moved up and down on the CRO screen, while the amplifier HT followed suit.

Presumably, a signal peak carried the particular output valve to a plate current and Gm condition where it would just build up sustained oscillations. Due possibly to clipping of the RF peaks and a shift in operating potentials, the presence of the oscillations reacted on the power supply, thence back on the valve to produce a feedback condition.

The same effect, in modified form was apparent on high amplitude sine wave output.

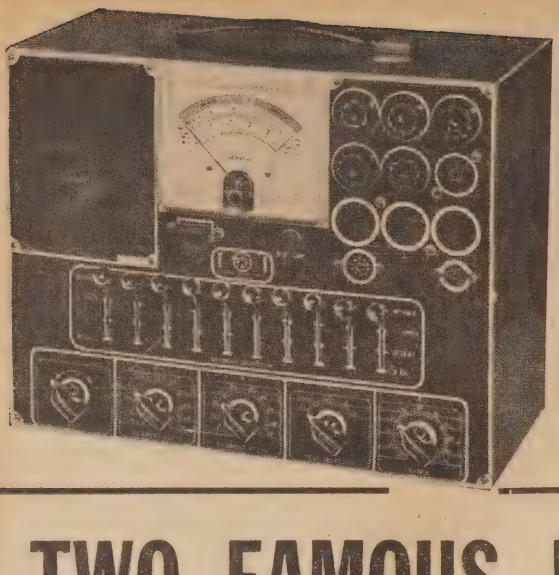
I didn't have time to pursue the matter further, nor to work out the ultimate details of the phenomenon.

The interesting point was that here was an amplifier which seemed to motorboat at high output levels. There was no sign of howling or screeching in the speaker—just the irregular flap-flap of the cone during output peaks.

The user may have been excused for resorting to extra decoupling and wondering why it didn't immediately clear up the trouble.

It took a complete test set-up, including a CRO to show that it wasn't a simple case of motorboating at all but a roundabout combination of triggered oscillator cum DC shift.

If there's a moral to the story, I guess that it's simply that 100pf can accomplish more than 100mf—if it's used in the right place.



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FROM THE SERVICEMAN WHO TELLS

Remember the old gag about married men not living longer than single men; that it only seems longer? Well, in similar vein, I am prompted to ask whether servicemen have more relatives than other people, or whether this only seems to be so. In any case, the result is much the same.

I started on a recent Saturday afternoon, just when I was settling down for a few hours of doing nothing in particular. First, relative No. 1 drove in with a car (well, new for him, anyway!). Then he proudly announced he was considering buying.

In connection he was faced with the major problem (among others) of deciding whether the radio was worth the £20 money being asked for it. Quite naturally, he turned to yours truly for opinion.

It all seemed straightforward enough. I settled myself in the front seat and proceeded to set through its paces. It certainly seemed sensitive enough, and there was plenty of power output. There was no hum, while the installation appeared to be free from ignition problems. In other words, electrically, it seemed OK.

THE TROUBLE

The only fault I could find at this stage was the dial movement. This did not line up with the station markings and was suffering badly from backlash. It did not seemed to be only a mechanical problem, I suggested it did not warrant re-conditioning the set at the price asked for it.

While we talked, I continued to fiddle around the various cables, and to give the set an occasional thump, just in case there was anything else wrong. Apparently there was, because I soon detected the sound of a "splat" somewhere inside the case. Thus it was that I finished up in the time-honored position—back on the floor, and feet on the seat—staring through the ventilation holes in the case.

It wasn't possible to see much inside, but I could pick the general area of trouble by the reflected light of the dial. Judging from the sound and intermittent character, I took it to be some sort of intermittent short in the low tension circuit: probably a stray strand of wire or sliver of solder. Anyway, I suspected that it would probably not be too bad and still not sufficient to condemn the set, especially as it had to be thrown out for dial adjustment, anyway.

NUMBER TWO

Just as I was making this pronouncement another car slid quietly up beside the first. Relative No. 2 waved cheerily through the window. (A sixth sense seemed to tell me that here was more trouble.)

He was right. After exchanging pleasantries and inquiries about our health, he came to the point.

"Jim—er—radio in the car isn't performing too well at the moment. I was wondering if you'd care to have a look at it. It's probably only some simple thing you can fix in a few minutes."

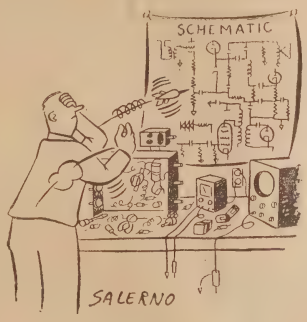
I groaned inwardly. Two car radio jobs in my afternoon off was too much, while I had my own ideas about the chances of being something that could be fixed in a few minutes. Car radios just don't have that kind of fault.

Finally, I suggested a compromise. Relative No. 1 had enough information to enable him to go ahead and complete the deal if he felt so inclined. If he did, I suggested that he bring the car back one night during the week and we would give it the once over. If relative No. 2 liked to come over at the same time we could probably give his the once over also. A case of killing two birds with the one stone—or trying to avoid ruining more than one evening!

However, I took the precaution of pointing out that a good deal of time could be saved if some of the mechanical work—dismantling, etc.—could be done in advance. Since they were both handy types with tools, I had no doubt that they could handle this part of the job easily enough.

And so I sent them on their way, and earned myself a temporary reprieve.

But, of course, it was only temporary, particularly as I learned later that relative No. 1 had completed his car deal, meaning that that job was definitely "on".



— RADIO-ELECTRONICS

In fact, it was relative No. 1 who turned up first on the appointed night, still proudly conscious of his "new" car. I drove my own car out of the garage and drove his in. At least, I could arrange adequate light and similar "mod. cons." in these surroundings, something which can take much of the "sting" out of working on car sets.

My comments about preparatory mechanical work had obviously borne fruit. The set was resting on the front seat (on a protective sheet of paper) ready for me to attack. There was only one snag; in order to track down the "splat" it would be necessary to connect the set to at least the power and speaker cables, and these were certainly not long enough to reach the seat.

It was the relative who finished on the floor of the car this time—holding the set above him in a position where it could reach the cables—while I prodded into the open underside of the chassis.

I'm afraid the "splat" must remain one of those unsolved mysteries. Nothing I could do would reproduce the condition, and I was forced to the conclusion that, if it was something foreign, it had since shaken itself free. Anyway, there didn't seem much point in worrying about it unless it showed up again. In the meantime, there was the question of the dial.

This we were able to study in somewhat greater comfort on the bench. Part of the trouble was due to a stretched dial cord which had become sloppy and fallen off one pulley. This was easily fixed. But the major fault was in the reduction gears between the dial and the gang, and this wasn't so easy. Connecting to the gang shaft were two fibre gears, spring-loaded against each other, and which engaged a worm wheel on the dial mechanism.

NO TEETH

In the normal way, the spring loading would eliminate any backlash, but now it was completely ineffective, due to one gear being virtually devoid of teeth. The other one wasn't much better, though it did still provide some drive—and plenty of backlash.

At this point I suggested that relative No. 1 could probably take over. It was clear that two new fibre gears were necessary and their method of use was obvious, so I could see no reason why one as skilled as he was in things mechanical (wonderful what a little flattery will do!) could not obtain, or even make, a new pair of gears and fit them in place. When that was done I would be happy to give the thing a final check-over.

He was quite agreeable to this arrangement, and when I fished a scrap of canvas bakelite out of the junkbox and handed it to him, he announced that he intended to "have a go" at making a set of gears. If this failed he would chase the manufacturer for a replacement set.

BRUTE FORCE?

I must confess to worrying about one point, namely, that the end of the gang shaft was too close to the side of the chassis-cum-case to allow the gears to come off. I could only resort to a little more flattery and the suggestion that he spring the side of the case gently—aided, perhaps, by a tyre lever!

Relative No. 2 had arrived by this time and was hovering in the background. We changed the cars over and tackled his problem, which turned out to be very poor sensitivity.

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HOMECRAFT'S *FAST* DESPATCH SERVICE

nstallation was a rather unusual
t was an English car and had
ritly been fitted with an English
oefore being shipped out here. As
st, it was completely foreign to
h the possibility that circuits and
lata, should I need them, would
b readily available.

Wh was even more intriguing was
p/sical layout of the set. It was
tw sections, one behind the dash
de in the engine compartment. The
hind the dash was quite small.
loon found out why. It contained
he aerial, RF, and converter
the IF channel, audio section and
e supply being in the larger con
n the engine compartment. Con
between the two was by means
impedance co-axial cable.

suggestion about mechanical work
nt gone unheeded here, either, but
blem wasn't so easy. Not all the
could be readily disconnected,
g that when the case was unbolted
d hang rather precariously from
ables, with the ever-present dan-
damaging them. However, for
ment, this didn't worry me.

, BUT TRYING

witched the set on and tuned over
nd. It was immediately obvious
rformance was very poor. A few
l tations could be heard, but well
in the noise level. At the same
he set itself gave the impression
ble sensitivity, with plenty of back-
noise when the volume was turn-
al.

ing struck such symptoms before.
w—or thought I knew—where the
lt was. A faulty aerial connection
sually give this effect, since the
virtually cut off from any signal
except that fed to it via the aerial.
e the aerial and you remove the
ds, although the set's natural noise
emains to give an impression of
sitivity.

ng an odd length of wire, I rigged
porary aerial outside the car, fed
ough the window, and touched it
aerial connection. This should
brought forth a solid burst of sig-
stead, results were no better than
ne car's own aerial.

seemed to rule out the aerial,
still felt that the fault must be
where in the front end, and almost
ly in front of the converter. This
ed the aerial connection within the
e operating conditions of the RF
e the valve itself, or the aerial and
oils.

ELP FOR IT

I could no longer put off getting
inside of the tuner. Once again
ative finished up on the floor. Hold-
set while I removed various cover
and began to find my way around

first thing that struck me when
moved the covers was the absence
ang, it being a permeability-tuned
. While I'm reasonably familiar
uch circuits, I wasn't particularly
about the possibility of an open-
aerial or RF coil in this set, what
the problem of obtaining, fitting
justing a new one, and a "first-aid"
hat.

wever, there was no point in meet-
rouble halfway; time enough for
when it happened. Using the im-
ed aerial, I traced out the aerial
through to the grid of the RF
valve. (At least, I assumed it was the grid. The valve was a type I had never encountered before and it certainly isn't listed in any of my data books. In the circumstances, I could only work out the pin connections the hard way.)

Right up to the grid of the valve there was no sign of signal, but as soon as I transferred to the plate pin the set came good. Maybe it did not have the extreme sensitivity provided by the RF stage, but it still gave a very good account of itself.

Well, at least I had pinpointed the general area correctly.

The next thing was to track down the culprit. In the ordinary way I would probably have substituted a new valve at this stage, but this wasn't possible. All I could do was test all around it. A test of the aerial coil showed continuity, similarly a shorts test across the trimmer proved it OK.

VOLTAGE CHECK

Next I tackled the valve voltages. This wasn't particularly easy, what with having to work out the pin connections and the socket being half built out by other components. But eventually I managed to measure a voltage which I took to be on the plate pin, another on the screen pin, then the cathode pin, and finally the heaters. All were near enough to normal.

At this point there didn't seem to be much else to test, and I was being forced more and more to the conclusion that the valve was the culprit. The only question was how to be sure.

Then it occurred to me that there was probably another valve of the same type in the IF section. Since this was working, it would provide a convenient means of checking the doubtful one. Also, by shifting the scene of operations, I was able to allow my assistant to adopt a more normal posture and restore the circulation to his legs.

The other sections proved to be a good deal easier to get at. Apart from removing the accumulated dirt and grease of several thousand miles, we had only to remove a few screws and lift off a cover to reveal the "innards". As I had expected, there was another valve of the same type in the IF socket. I pulled it out and pushed in the doubtful one, then returned to the front end section to see if I could get a signal through from the RF plate pin.

The set was as dead as the proverbial dodo, thereby seeming to confirm my suspicions about the valve. I swapped the dud valve back and forth a couple of times, just to make sure, then left it in the IF section, putting the good one from the IF section into the RF stage.

THE END OF A STORY———!

First off, this month, I must apologise for what must have seemed like a very abrupt departure on my part last month! At the bottom of page 83 I was struggling with an ancient autodyne (at that stage still suffering from general "soupiness" and a touch of laryng'tis), and there, like the hero in the Saturday afternoon serial I was left in a state of suspended animation, without even the advantage of a "continued in our next" caption.

Don't ask me how it happened. All I know is that somewhere down in the bowels of the building the last half-column or so of my story went astray. I imagine the result must have been extremely frustrating, so here is the missing portion. I quote myself:

"Whoever had sought to fit the extra volume control had taken a lead from the bottom of the IF winding, across the chassis to the moving arm of the volume control. The hot end of the control had been connected to the insulated pickup terminal—again via a long lead—while the other end was run to chassis.

"The probable result of all this, from a stability point of view, was pretty horrible to contemplate. Not only was the

[illegible] long and running past earlier stages of the set, but it was also being held above chassis potential by any resistance between the moving arm and either end of the pot. It was surely tempting fate too far to expect that it would always be at either one of its two extreme positions.

"The trouble could probably have been overcome by by-passing the bottom end of the IF transformer, but I decided instead to take the 'foreign' wiring completely out. For one thing, the owner had indicated that he no longer used the pickup terminals, and, for another, I didn't consider it a particularly good arrangement, anyway.

"With the circuit restored to its original form, the 'soupiness' vanished and the performance was considerably improved. Naturally, I had to re-align the IF transformer after altering the wiring.

"The only thing left was the suspicion of distortion, which I had previously noted. As I said earlier, I don't believe it was any more than was normal for these old sets (after all, the anode bend detector was a pretty poor device), but I reasoned that any simple thing I could do to improve it would be worth while.

"Negative feedback seemed to be the best approach and it took only a couple of minutes to wire a 1 meg. resistor from the output plate to the detector plate. The loss this produced wasn't serious, but it did improve the performance quite noticeably. As well as lopping off some of the more vicious harmonics, it had also attenuated what appeared to be a nasty peak in the middle register—probably due to the speaker transformer characteristics.

"By now the set's performance was [illegible] other domestic receivers, even if it did lack some of the extreme gain and such refinements as AVC. The owner was very happy, which was understandable. After all, I had saved him the price of a new set."

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d a good reason for doing this. known good valve in the RF we could put this back together, place, and forget about it. The alve—if and when I found one— e replaced in the IF section with fraction of the effort required to the RF valve. Which meant, in hat I wouldn't necessarily have en hand to fit it.

e wasn't much more we could do ight, apart from putting things r again and cleaning up the mess. e time we had done that, Mrs. man had brewed a pot of tea—ing we all found most accept-and, after we had imbibed, my es went their respective ways. All to do now was find a replacement valve which most people had ly never heard of!

next day, after many fruitless one calls, I finally tracked down a who had one—and only one—away in a corner of his stock. I ched it to relative No. 2 and was ed in due course that it had done ck.

aven't heard any progress report relative No. 1 yet, but I expect drive up any Saturday afternoon nd take me up on my offer of a heck over and alignment.

well, it's nice to see one's relatives asionally!

IGHTER VEIN

ll now, in somewhat lighter vein, I must pass on a couple of amus-d mildly frustrating incidents re-t related to me by the victims them-ve.

first one concerns a colleague who een to test the effect of using a quality speaker on an ordinary run-ll-mill mantel set. His contention hat many of the audio systems em-y high fidelity fans are need-l elaborate, and that most of the provement is due to the use of high ay speakers and, possibly, output ormers.

prove his point, he proceeded to ject a high quality, multiple cone, ted speaker to the family mantel . Naturally the impedance of the set's normer was not suitable, so he bor-wed a high quality speaker trans-rmer and wired it temporarily into the . Since it was nearly as big as the elf, he simply sat it on the mantle-ce behind the set.

is, this is a genuine, authenticated se of a mantel set being used on a antelpiece. I understand that this ni with the case of the motorist who as known to keep a pair of gloves in e lovebox of his car.)

wever, to return to the story. The ne seemed to work quite well, and least as far as my friend was con-rned—supported his theory most effec-ve. The only snag he could find with as a rather annoying background m and he put this down to the limita-on of the simple power supply in the antel set.

AGNETIC PICK-UP?

a simple way of confirming this alled the rectifier out of its socket, the hum kept merrily on exactly as fore. This suggested that the output nsformer was picking up hum from e power transformer, a not unusual currence with wide-range gear.

ne way of proving this, and some-times of curing the effect, is to orientate the output transformer relative to the power transformer until the magnetic coupling is at a minimum. Instead, my friend adopted a more brute force technique—he simply switched off the power.

It rather rocked him when this didn't alter the hum level, and when he pulled the plug out of the power socket and the hum was still as strong as ever, he (to use his own expression) "... thought the thing was haunted!"

For a while he just stood and gazed at it, scratched his head, and wondered what on earth was going on. He was on the point of ringing up the newspapers to see if the phenomena would qualify along with jumping stones and self-burying hoses, when wiser counsel prevailed and he set about finding the cause.

Almost the first thing he did was to move the output transformer several inches along the mantelpiece, whereupon the hum vanished as if by magic. Then the truth dawned. The transformer had been sitting alongside an electric clock, and apparently the field from this was strong enough to induce quite a substantial level of 50-cycle energy into it.

As my friend said, "You wouldn't read about it!" (Well, not up till now, anyway.)

My second story also concerns a high fidelity fan, but this time on the subject of tuners. Originally my friend had built himself one of the Wide-Band Tuners to go with a fairly elaborate Playmaster outfit, and was very happy with the arrangement until he was bitten by the FM bug.

So he built an FM tuner, and the performance of this was so impressive that the humble AM tuner was relegated to the workshop shelf. There it collected dust for many months, and would probably have continued to do so had not some discussion arisen between himself and a friend as to the relative merits of the two systems.

So, to refresh his memory on the subject, he pulled the tuner down from the shelf, brushed the dust off it, and plugged it in. It worked immediately in much the same manner as it had always done, except that there was an occasional slight crackle behind the program.

The idea that immediately sprang to my friend's mind was that one of the IF transformers had a dicky winding which was about to go open circuit. However, ignoring this for the moment, he was able to use the tuner for a couple of hours to familiarise himself with its standard of performance.

Having done so, he pushed it back on the shelf, not feeling disposed right then to delve into the works and find the exact cause of the trouble. Since he was still very happy with the FM tuner it might have remained on the shelf indefinitely had it not been for the advent of a special musical program on one of the commercial stations a few weeks later.

This prompted him to take the tuner off the shelf once more and devote a Saturday afternoon to putting it back in proper working order. Sure enough, the crackle was still present and, if anything, rather more noticeable. It seemed like a perfectly straightforward job.

And yet, a half-hour or more later, my friend was still puzzling over the problem. The trouble seemed to be somewhere around the aerial circuit, but that was as far as he could track it. Furthermore, it seemed to be getting worse. While still pondering over the problem he suddenly became aware of the need for more light on the job, and reached out and pressed the switch.

Then he did a double take and asked himself why he needed the light on at this time of the afternoon. One glance out the window was sufficient. Heavy black clouds were rolling up and there was an unusual stillness in the atmosphere.

We're in for a storm, thought my friend.

Storm?

Static?

Oh, no!

Oh, YES! My friend had been well and truly caught. It was so long since he had listened to an AM tuner that he had almost forgotten that such a thing as summer static existed. Used to the almost uncanny quiet of his FM tuner, he had naturally assumed that any foreign sounds must be due to a fault in the tuner.

And now he came to think about it, the previous time he had tried the tuner it had also been a hot, oppressive afternoon, with the threat of a storm in the air. Admittedly it had not been as bad as on this occasion, but still bad enough to deceive him with a steady background crackle.

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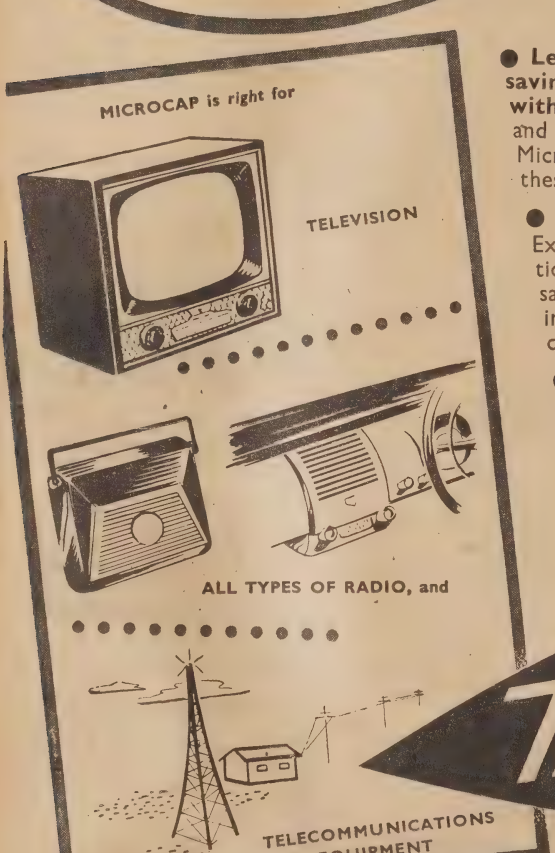

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fence of my friend, in case you
be tempted to look askance at
who could be caught so readily,
point out that he is merely an
at the game, a hobbyist, who
a remendous kick out of building,
out, and, yes, discarding, most
cuits as they appear.

he told me this story against
and with many a chuckle at
expense, I have no hesitation in
it as absolutely genuine.

only other comment I can make
if my friend had any doubts
he effectiveness of FM to reject
hey have been most effectively
d.

HERE'S YOUR ANSWER, TOM!

(Continued from Page 47)

of a blow-lamp rather than the
opper bit.

will note from the foregoing that
ter-quality solders contain a ma-
of tin and melt at lower tem-
es, and find application in better-
d finer work, where the quan-
solder required is not great.

**What is meant by transconduct-
ce' Are valves with a high
nsconductance better?**

nsconductance denotes the ratio of
ge in plate current to the change
voltage which produces it, all
otentials remaining fixed. It may
expressed in mA/Volt or in micro-
s. The mho, being the unit of con-
ce, is the reciprocal of the ohm.
ohm spelled backwards.

he grid voltage on a valve is
e the plate current varies in sym-
y and, in general, the less the re-
e change in grid voltage for a
nge in plate current, the more
l is able to amplify. Such a valve
id to have a high transconductance.
practice, high transconductance
e are more critical to manufacture
pes having lower transconductance
ne element spacing and tolerance
e o be reduced to very difficult
s

h transconductance valves are also
critical in use, because of their
ncy to oscillate and to be upset
ater than optimum working poten-

owever, a great deal of modern
ment is only feasible because of
ransconductance valves, television
rs being the most familiar ex-
le.

So you see, Tom, it isn't just a mat-
of one kind of valve being "better"
another. Transconductance is only
e many characteristics possessed by
e, and there is place in the scheme
things for valves of widely differing
racteristics.

"MEMORIES" for high speed elec-
ronic computers may be made
photographic material insead of
gnetic drums of "memory valves".
dvantage is the large amount
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individual discs, but it cannot
cessed with the same ease a
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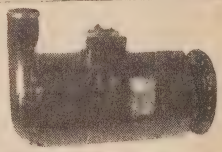

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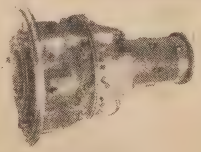

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MPLETING YOUR WIDE BAND CRO

rt:les describing the circuitry and mechanic al features of our wide band oscilloscope for lelision testing have appeared in the Febru ary, March and April issues. The following, hih was omitted from the April issue due to lack of space, covers the final adjustment of the new instrument.

by Maurice Findlay

n a general description of the cir- now move on to consider the nt of the amplifier for optimum nce. The importance of care ng out the procedures cannot be nphasised, since highly distorted ions of angular waveforms can m incorrect adjustment.

is a tendency nowadays to talk plifier characteristics in terms se to steep fronted waves rather quency response. There is a sis for the newer approach, but that readers will be able to the desired result easier by con- frequency response.

xact procedure you adopt will on the instruments available but ficult to adjust for satisfactory nce without a signal generator up to about 5 Mc/s. The in- should be fitted with some output meter, giving indication mplitude of the signal.

ALE INSTRUMENTS

generators generally available nded mainly for adjustment of ceivers. The maximum output of the order of 1 volt and am- s read by the meter may not accurate. Absolute accuracy is portant in this case as the abil- ct a constant output over the nge and while the 1 volt level on the low side for some tests, fficient to achieve the required he output impedance will nor- of the order of 100 ohms or , therefore, the generator may rected across the 2200 ohm re- with only a small reduction in

ave voltmeter with a low capaci- obe is also desirable. A descrip- suitable probes appeared in the r, 1956, issue.

rd desirable instrument is a ave generator capable of deliv- square wave with fast rise time encies between 1000 c/s and . The audio signal generator de- in the September, 1955, issue o, Television and Hobbies is ex- or the job.

RARY LINKS

ce switching on, the vertical am- hould be wired with connecting cross the positions which will e occupied by the peaking chokes e 6BX6 plate circuits. The re- the 6CK6 cathode circuit will ably be a 2000 ohm 20 watt unit adjustable tap. It should be maximum resistance initially. ing made sure that there is noth- obviously overloading, the cathode for the 6CK6s should be set the total cathode current is 70 h the spot in the centre of the screen. Provided all resistors in the output circuit are of the correct value and the high tension supply is of the correct voltage, optimum operating conditions for the output valves will automatically be established.

Connect the signal generator to the plate of the 6BX6 driver valve through a small capacitor, say, .01 uF and set the output to give suitable pattern height You will probably be limited here by the output capabilities of the generator.

Check the frequency response of the output stage at half Mc/s intervals from 1 Mc/s to 5 Mc/s. It will probably be found that there is a rise in the gain at frequencies around 2 or 3 Mc/s and it may be a good idea to take a few extra readings at or near the peak. The response will fall off rapidly at higher frequencies.

The characteristc is due to the self-inductance of the output load resistors. Resistors from two manufacturers which were tried in the instrument had more inductance than is required for the optimum characteristic. The easiest way to reduce the inductance to the desired value is to solder a band of shim brass or copper around the body of the resistor in such a way as to form a short circuit turn. Reinforce the solder with a pair of wire loops in each case.

In our case the optimum inductance was obtained with a band $\frac{1}{4}$in wide soldered to be a tight fit around the centre of the body of the resistor (Figure 3). Some control over the inductance can be obtained by sliding the band along the body of the resistor, the reduction in inductance being greatest with the band at the centre.

In any case it is a matter of trial and error to obtain a characteristic for the output stage which does not rise appreciably above reference at any frequency.

Actually, the optimum characteristic is obtained when the response rises about 3 pc at the peak, but for best reproduction of steep fronted waves it is probably better to err on the side of under-compensation.

Provided you have wired the instrument so as to keep stray capacitances to a minimum, the frequency for 70.7 pc response will be between 3.0 and 3.5 Mc/s.

The next step is to arrive at a peaking inductance for the plate circuit of the driver 6BX6. While the approximate value given by the circuit would probably not be seriously in error, we suggest that a check be made.

The cathode-ray tube itself is no longer a good indicator, since the frequency response of the driver stage should be better than that of the output amplifier. However, a crystal diode valve voltmeter probe can be connected to the plate of the 6BX6 and used as an indicator. The resistive component of the load it represents will normally be high compared with the load resistance and may be neglected while the capacitive component of a well-designed probe will be only a few pF and can be allowed for in the calculations.

DRIVER COMPENSATION

Output from the signal generator should be connected to the grid of the 6BX6, again through a small capacitor. The lead to the range switch should be disconnected. The level from the generator should be such as to give a reading of only about 1 volt rms to ensure that the stage is operated well below the overload point.

The frequency response curve for the amplifier should then be drawn. You will probably find that the gain is 70.7 pc of its mid frequency value at about 2.4 Mc/s. If widely different, some further investigation is necessary. It may be that the probe has a high capacitance.

Provided the shunt capacitance of the probe is small compared with the total shunt capacitance, you can adopt a procedure similar to that used to adjust the output stage. However, the calculations when allowance is made for the probe capacitance are quite simple.

The frequency you have already found is the frequency at which the reactance of the total shunt capacitance is equal to the load resistance. Therefore, you can find the total shunt capacitance from:

$$C = \frac{1}{2\pi f X_C} \mu f$$

when load equals 2,200 ohms and f is expresed Mc/s.

$$C \text{ shunt} = \frac{72.5}{f} pf$$

The value obtained in your case may be a little less than 30 pF. From this value must be subtracted the capacitance of the probe. Let this value be C without the subscript. Then the frequency at which the stage would have been 3db down, had the probe not been present, can be calculated from:

$$f = \frac{1}{2\pi R_1 C}$$

with the load at 2,200 ohms and C in pf.

$$f = \frac{72.5}{C} Mc/s$$

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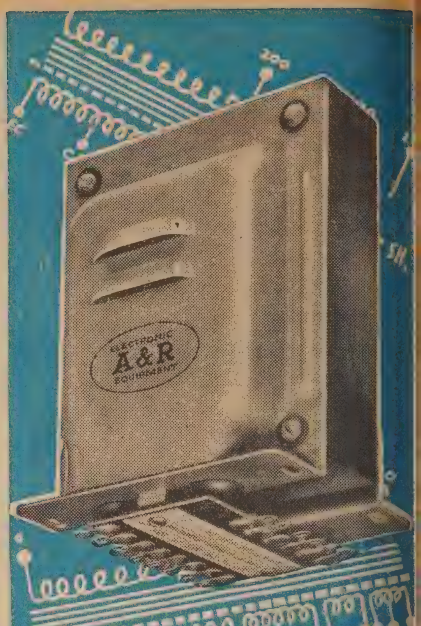

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1768	,,	,, ,, ,,	325 — CT — 325	
1769	,,	,, ,, ,,	350 — CT — 350	
1770	,,	,, ,, ,,	385 — CT — 385	
1771	150	200 — 230 — 240	285 — CT — 285	5v—3A; 6.3v—2A; 6.3v—CT—2A
1772	,,	,, ,, ,,	325 — CT — 325	ditto
1773	,,	,, ,, ,,	350 — CT — 350	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1774	,,	,, ,, ,,	350 — CT — 350	5v—3A; 6.3v—CT—3A; 2.5v—5A
1775	,,	,, ,, ,,	385 — CT — 385	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1776	175	200 — 230 — 240	285 — CT — 285	
1777	,,	,, ,, ,,	325 — CT — 325	
1778	,,	,, ,, ,,	350 — CT — 350	All in this Section
1779	,,	,, ,, ,,	385 — CT — 385	
1780	200	,, ,, ,,	350 — CT — 350	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1781	200	,, ,, ,,	400 — CT — 400	
1782	200	,, ,, ,,	450 — CT — 450	
1400	250	200—220—230—240	565, 500, 425 A side	2 x 6.3v—3A; 2 x 2.5v—3A; 5v—
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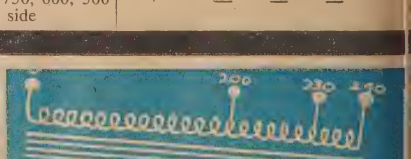

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ew frequency will obviously be
an that previously measured.
required compensating inductor
lave a reactance equal to half
resistance for the frequency con-

ductance can be calculated from:

$$L = \frac{X_L}{2\pi f}$$

when f is in Mc s and the load equals 2,200 ohms.

$$L = \frac{175}{f} \text{ uH}$$

alues required for both peaking
are too large for them to be
nveniently as a single layer coil,
suggestion is that you obtain a
ction multi-layer RF choke and
turns until you obtain the re-
inductance. Most chokes have
ably more inductance than is re-
nd you will probably find that
the turns are wound off when
h the required value.
gle section choke is all that is
Multi-section chokes have a
ray capacitance, but this is not
t for the oscilloscope applica-

an accurate RF bridge or a
, the inductance of the choke
b measured by the resonance
using the valve voltmeter as an
. The additional capacitance
y the voltmeter probe can be
have a negligible effect on the
by using a large capacitor as

25 pF mica capacitors used as
in broadcast receivers are par-
useful since they are available
olerance of 2½ pc and you are
have one on hand.

e signal generator frequency
doe adjusted for maximum volt-
dication when the inductor under
isconnected in the circuit shown
ge). Although the Q of the
it will be low because of the re-
e lamping it will be possible to
e frequency of the peak with
od accuracy. The value of in-
e can be calculated from:

$$L = \frac{1}{4\pi^2 f^2 C}$$

e he fundamental units of cycles,
e and farads are used. However,
e prepared a graph (Figure 11)
the inductances you are likely
ire in order to save the trouble
alculation.
ng installed the inductor, it is
k of a moment to check the fre-
response characteristic of the
fier from the grid of the 6BX6
o make sure that there are no
s in the range.
procedure for adjusting the 6BX6
plifier is much simpler, since the
may be connected to the cathode
12AU7 cathode follower without
g the response appreciably.
nly, the compensated attenuator
the input circuit and the 6BX6
mains to be adjusted.
is job can be done with a signal
ator by plotting frequency response
but with the number of variables
lved the job becomes so difficult as
almost impractical.
suggestion is that you use a square
e enerator. The frequency for the
sensitive indication of the correct
stment appears to be about 3 Kc/s

but any frequency near this value will be satisfactory.

Start with the attenuator switch set to one of positions 7. 8 or 9 and with a suitable amplitude square wave on the screen adjust the trimmer capacitor across the 1.0 meg. resistor in series with the input for optimum square wave. The adjustment should be quite sharp, too much capacity giving a peak and too little capacity a slow rise time (Figure 14).

For this adjustment the trimmer in parallel with the 5000 ohm resistor should be set at half value. Actually the range of a 3 to 30 pF trimmer is too small to affect the result greatly and the component could be left out.

Alternatively, a larger trimmer could be used, say a compression broadcast padder or TV drive control, and the value of the parallel capacitor reduced from .001 uF to .00068 uF.

Switch then to one of ranges 4, 5 and 6 and note if an optimum square wave can be obtained within the range of the trimmer. If not, it may be necessary to use a value other than the 100 pF shown for this range.

However, do not make any changes at this moment, but switch to one of ranges 1, 2 and 3 and note if the correct adjustment is within the range of the trimmer. It may be that the capacity cannot be reduced sufficiently to allow a reasonable margin for adjustment. In this case it will be necessary to increase the value of the trimmer across the input resistor. This, in turn, will make it necessary to increase the capacity for ranges 7, 8 and 9, and the procedure just outlined will have to be repeated.

It is well worthwhile taking the trouble to select values such that each trimmer has a range either side of the correct adjustment so that if a realignment is necessary later it can be undertaken without the need to change components.

Incidentally, it will be necessary to remove the front panel to change the mica and paper capacitors, which is another reason for care in adjustment. (Figure 6).

Last of all the optimum capacitor values for ranges 10 and 11 should be found. The values are too large for trimmers and you will be hampered probably by the lack of a signal of sufficient amplitude.

The optimum results may require several odd value capacitors across the 500 ohm resistor rather than the two shown by the circuit.

Check all adjustments several times before replacing the front panel, and make sure that all trimmers have sufficient mechanical stability to maintain their adjustment with reasonable vibration.

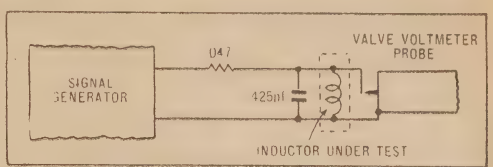
Both the trimmer capacitors and the mica capacitors tend to have a small positive temperature coefficient and, therefore, the adjustment of the divider should not be affected appreciably with change in temperature. Paper capacitors are not quite so predictable, but their values should not change appreciably with ordinary temperature changes and within a reasonable period.

There remains to be described a probe suitable for use in conjunction with the instrument and with an input impedance high enough for investigation of some of the more critical circuits of television receivers and other electronic equipment. The description will appear in an early issue.

A classic method of obtaining a high input impedance is to design an attenuator probe with a ratio of, say, 10 to 1 or 100 to 1. Remembering the characteristics of the input attenuator of the instrument it will be fairly obvious that it is possible to swap amplification for an increase in input impedance.

This is excellent for measurements on high amplitude signals but does not help when it is desired to measure voltages requiring the maximum amplification of the instrument. The solution here appears to be to employ a cathode follower. An attenuator can be placed in the input circuit to take care of high amplitude signals.

Finally, you may have noticed that a terminal for beam modulation has been included on the front panel. It also remains for details of the connections to be given.



Peaking inductors can be checked in the above circuit which requires a signal generator and a valve voltmeter. The frequency / inductance curve for 425 pF published last month will save calculation.

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A COURSE IN TELEVISIO

PART 21—AUTOMATIC GAIN CONTROL (Continued)

In the more advanced receiver designs, "keyed" or "gated" AGC is often used. This artic explains briefly why such circuits are preferred and how they operate.

THE general requirements of an AGC system were outlined in last month's article

Re-stated briefly, an AGC system must prevent overload anywhere in the video chain, it must hold the receiver gain as near constant as possible and not prejudice the set's performance on weak signals. It should not adversely affect the selectivity curve nor react unduly to noise pulses.

It should respond preferably to the peak output power of the station on synch pulses only—not the video level—yet should be able to act fast enough to counter the worse effects of aircraft flutter where this is a problem.

No simple AGC system can meet all these requirements completely.

SIMPLE AGC

With good design a simple AGC system can give the requisite voltage delay for weak signals and can be apportioned to minimise overload troubles. It cannot give a completely flat control characteristic, however, so that some increase in contrast is inevitable with rising signal input.

Since simple AGC is operative continuously it must generate additional bias in the presence of strong noise impulses and it must react also to changes in video level.

In many cases these latter effects may pass unnoticed, particularly if the receiver's synchronising and deflection circuits are themselves reasonably proof against disturbance. Such would be the case, for example, with a well-saturated synch separator and a "flywheel" type line circuit.

A fast-operating time is scarcely practical with any simple AGC system, partly because it tends to follow and to counter the video level too markedly and partly because it interprets each frame synch group as a rise in carrier amplitude.

FRAME PULSES

It therefore introduces an extra bias each fiftieth of a second and lowers the receiver gain for the duration of each frame synch group. In a marginal case this could spell the difference between synchronisation or not, or, at the very least, it could prejudice proper interlace of the alternative fields.

Just how apparent this integration effect can be is illustrated by the tracings of figure 127.

Diagram (a) shows the waveform on the AGC line of the RT and H receiver with only small value filter capacitors. Diagram (b) shows the same point in the circuit when bypassed with a 0.5 mfd tubular capacitor.

Some commercial receivers use electrolytic bypass capacitors on the AGC line to avoid this effect, even though there may be no immediate danger of loss of synch in ordinary service areas.

The basic idea, in a "keyed" AGC system is to "sample" the incoming signal only during these instants when line synchronising pulses are being radiated.

Since the peak power on pulses is a constant for any given station the automatic gain control voltage derived therefrom is not affected by variations in video level during the picture mission periods.

The control voltage is likewi affected by noise pulses which during this same comparatively period. The only pulses which can the AGC are those which co exactly with the line pulses: this sents a very small percentage total time and, in any case, they to compete in amplitude with the mitter's peak carrier power.

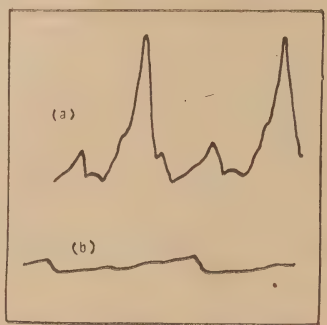

Figure 127: Traced from the screen of an oscilloscope, diagram (a) shows the integrated frame information which appears across a simple AGC network having too short a time constant. Diagram (b) shows the effect of extra bypass capacitance on the same point.

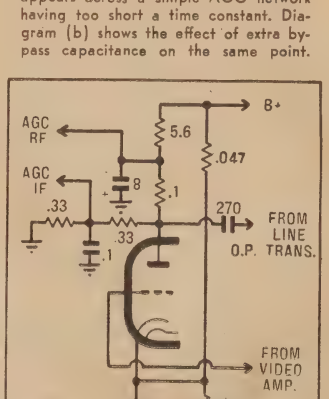

Figure 128: Here are the essential details of a keyed AGC system extracted from the Philips developmental receiver described in May 1956. The text explains how an apparent positive potential from the B_plus line becomes negative and suitable for AGC.

INTEGRATION EFFECT

A further point is that because a system is operative only for abo duration of a line pulse it cannot extra energy from the longer pulses. It therefore does not te produce an integration effect a desired, the system as a whole designed for a very short time co sufficient to follow aircraft flutter.

In practice not all keyed AGC s take advantage of this possibility, nevertheless exists.

Designers appear to be more in ed by the order of the control v which can be derived and by the of the system to produce an exactly level output from the video tor, with input signals ranging fro than 100 microvolts to a quarter-v more.

Automatic gain control of this eliminates the need for constant m lation of the contrast control and non-technical members of the hou to rely almost completely on the ness control, which is rather obvious in its function.

The principle of a keyed AGC is simple enough. The actual video from the detector or from a video fier is fed to the grid of a se control tube.

The potentials on this tub arranged so that it is not normall ducting and it therefore does not a the video information.

LINE PULSE

However, a pulse of energy is the tube from the line output former, allowing the tube to c during the line flyback period onl

Assuming that the picture is co synchronised this flyback period correspond with the line pulse fro station, so that this is the only pi information amplified by the tube. The significance of the "keyed" or "gated" becomes o enough.

When it conducts, the control t made to generate a negative pot which charges a storage capacito becomes the basic automatic gain c voltage. This is then distributed controlled stages in the required p

s for any other AGC network.

igure 128 shows the essential details a keyed AGC system in the Philips el mental receiver, described in the y 956, issue. The circuit arrange nt uzzled several RT and H readers b ubsequently wrote in for an ex nation of it.

t ill be apparent that a DC circuit prent between the B-plu line and GC line, this latter, in fact, being nected directly to the plate circuit t control valve. This fact led ny o assume that there was an obvi ror, as otherwise a positive volt build be applied ultimately to the n led grids.

nctual fact, there is no such error e circuit is quite a typical one. explained earlier, the control tube ated AGC system is normally held t off and this much is fairly appar om figure 128.

ATHODE POTENTIAL

lished data on the circuit suggests he cathode is held to a potential 15 volts with respect to earth by K and 56K resistors. The effec ate-cathode voltage will be of the reorder, representing the difference wn the HT supply and 105 volts. Obviously. the valve cannot draw a ng plate current unless the grid ught up very nearly to the cathode e ial.

n practice, the grid return is to a what less positive point than this he valve does not draw any signifi t tanding plate current.

t ill be noted, however, that a pulse plied from the line output trans r to the plate being ,in fact, a posi e ing pulse and having an amplitude th particular circuit of approximately olts peak.

n the presence of a signal, but with he oscillator not necessarily locked, positive going video voltage is fed o the grid, the pulses on plate and oth tending to carry the valve to n conduction. Due to the random ap nship between grid and plate ls, very little conduction may occur. However, when the line oscillator ck normally, the positive pulses on ate must occur simultaneously with he pulse peaks on the grid. Under es conditions the valve will conduct brief interval during each line nd. pulse, with idle periods in between.

ECOMES NEGATIVE

Most of the energy which flows dur g onduction pulse comes from the e ircuit and from the 270 pf capaci r, o that the plate side of this capaci r s made negative with respect the p ite side.

In actual fact, the voltage drop which p rs across the 270 pf capacitor and cr s the plate load resistors during the eri d of conduction is greater than the rmal plate voltage. Therefore, dur g the resting periods, the plate is tully carried negative by an amount, epending on circuit operation and ad st ent.

This average negative voltage is stored s charge in the two AGC by-pass p itors shown and becomes the con ol voltage from the RF and IF stages. According to published circuit data the easured plate current would be some r less than 30 microamperes, depend-

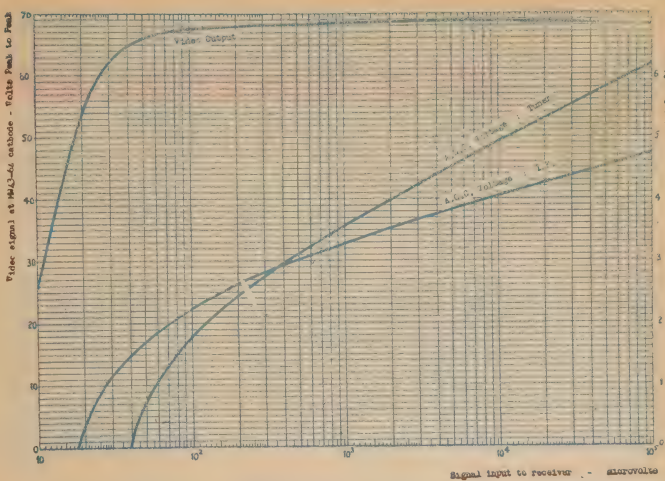

Figure 129. The AGC characteristic obtained from a typical well designed keyed system. Note that the video output level remains substantially constant for all signal inputs in excess of about 40 microamps.

ing on the video level. This would represent the average value of a current which has a substantial peak value but which flows for only a very small portion of the total time.

The plate potential would read as negative on a meter but oscillographic examination would show positive pulses, during which time plate current could flow. Across the AGC bypass capacitors a filtered negative DC potential would be apparent, varying only with changes in signal level.

This should explain the apparent anomaly of having an AGC line return a valve plate circuit and then to the the B-plus supply.

When no signal input is present and the valve fails to conduct, a positive potential may, in fact, be transferred to the AGC line. This does not cause any embarrassment, however, because the very large amount of resistance in circuit prevents current flowing which would endanger the controlled valves.

In fact, a small flow of grid current serves to keep the grids very close to earth potential and to ensure maximum sensitivity.

The AGC network as a whole is designed to apply the full control voltage to the RF amplifier once the initial delay for very weak signals has been overcome. Only about half the available voltage is fed to the IF amplifier, in line with practice explained in the previous instalment.

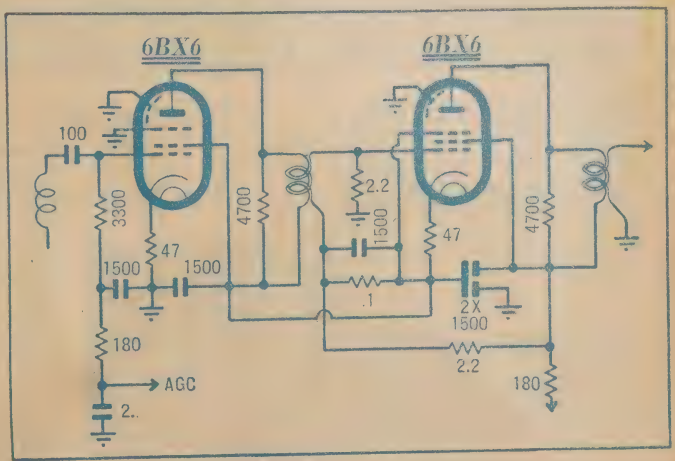

Figure 130: Extracted from a current commercial design this circuit shows two IF amplifier stages connected in series as far as DC supply is concerned. An AGC potential applied to the first grid controls the plate current and transconductance of both stages.

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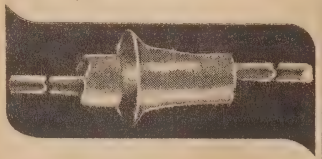

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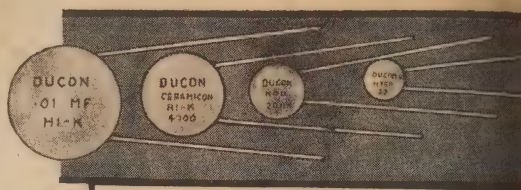

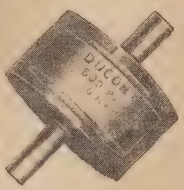

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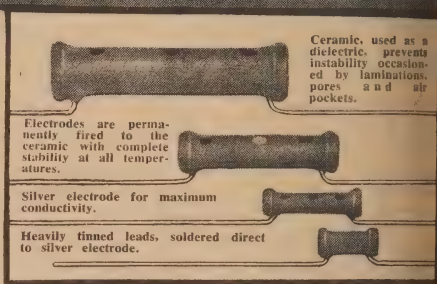

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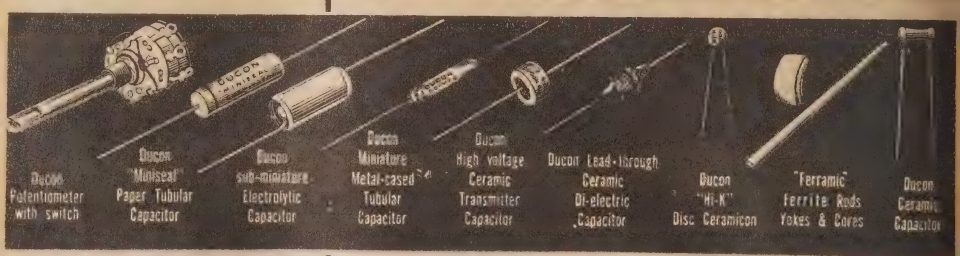
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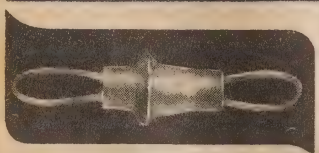

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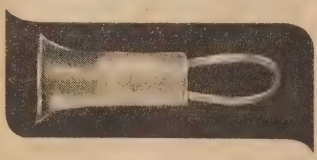

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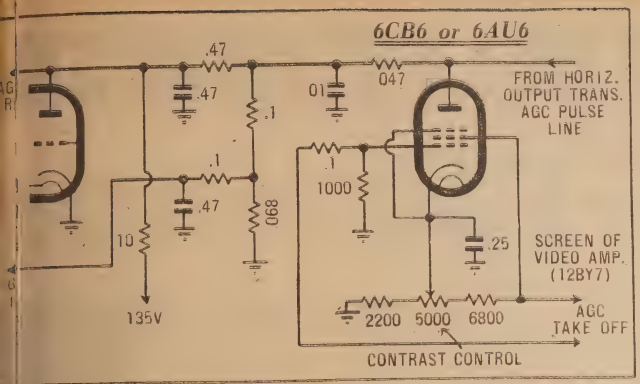

ge 131: A keyed AGC circuit suggested by the A.W. Valve Co. Applications La- tory. Its operation is comparable with the previous example but the cathode ntiometer can be used as the receiver's Contrast Control. The circuit is well id for use with the RT & H 17-inch receiver described elsewhere in this issue.

ire 129 shows the AGC character- btained in the Philips develop- t receiver from the general circuit ement shown in figure 128. It will sn that the video output level re- n substantially constant for input a above about 40 microvolts. The e of control voltage applied to tuner amplifier is also shown.

Vle considering the application of .C.o an IF amplifier reference could e made to an interesting circuit rement illustrated in figure 130. s taken from a current commercial er.

At first glance AGC would appear to plied only to the first amplifier he second being returned to earth 2.2 megohm resistor.

ES IN SERIES

ker inspection, however, shows that o valves are connected in series as their DC supply is concerned. while the grid and cathode circuits first valve are normal the plate reen connect to the cathode of cond valve.

Electron current passes through this to the plate and screen, thence to T line. Bypass capacitors at stra- points prevent unwanted interstage ng at signal frequencies.

resistor network in the grid cir- f the second valve tends to hold id at about half the HT supply ial and the cathode tends to float ut this same potential. Thus, under signal conditions and with no AGC resent, both valves operate at full with an effective plate-cathode ial equal to about half the supply. en AGC bias is applied to the first its plate current tends to fall, so begins to appear as a higher than l impedance in the cathode return of the second valve.

is tends to reduce the plate current second valve but, in any case, the lves must draw identical total cur- since they are connected in series. an AGC bias which reduces the current of the first valve must re- the plate current and the trans- ctance of the second.

with any "cascade" circuit, the ction of two units or valves in results in a distinct saving in current drain.

Figure 131 shows a slightly differe keyed AGC circuit, which warrants special mention. It is, in fact, well suited for use with the 17-inch receiver circuit described elsewhere in this issue

The grid of the control valve is connected directly into the plate circuit of the video amplifier, where it receives a standing positive potential, on which is superimposed the positive-going video information.

At the same time, a positive potential is present on the screen and an adjustable positive potential on the cathode. The plate has no standing potential so that in normal circumstances, no plate current can flow.

When video information is applied to the grid and synchronised positive-going pulses reach the plate, bursts of plate current flow which build up a charge across the supply capacitor, negative with respect to the energy source.

As a result of these current bursts and the charge built up, the plate tends to acquire a resting negative voltage, which is communicated to the AGC line and thence to the controlled grids, as already described.

The AGC distribution network is conventional enough, involving the usual decoupling and feed resistors and provision for clamping on the line to the tuner.

Adjustment of the cathode potential controls the amplitude of the plate current pulses, the charge built up on the AGC line and therefore the signal level at the video detector.

The control characteristic is very flat, being comparable with figure 129, and the curve can be levelled off at various video output voltages, depending on the setting of the cathode bias potentiometer.

CONTROL CHARACTERISTIC

In actual fact, the control is of sufficient order to serve as a contrast control for the receiver. The arrangement has obvious advantages, since it avoids the attendant changes in DC level, which often occur with contrast controls operating purely in the video amplifier.

The circuits shown in figures 128 and 131 are typical of keyed AGC practice but, needless to say, many variations therefrom occur in practice. The reader should, however, be able to work out their operation in the light of fore-going remarks.

In general, difficulties with keyed AGC circuits stem from their dependance on the presence of synchronised video and flyback energy.

If synchronisation is lost, for any reason, the AGC voltage may disappear, leading to severe overload in the high frequency stages and the possible loss of synch pulses due to clipping.

A vicious circle may thus be created which masks an original fault with a variety of other apparent faults. Unless the serviceman appreciates the interdependance of keyed AGC with other portions of the circuitry, much time can be wasted.

The very flat control characteristic, which a keyed AGC circuit provides, is due primarily to the gain of the amplifier stage, rather than to the fact that its operation is keyed to the line-scan circuit.

Because of this gain, a very small change in video signal is sufficient to effect a significant change in the plate current of the control tube and therefore in the potential on the AGC line.

Since the RF and IF tubes are themselves high-GM types and sensitive to any variation in control voltage, it simply means that a very small change in video level can effect a large change in RF and IF gain — hence the flat AGC characteristic.

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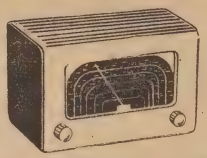

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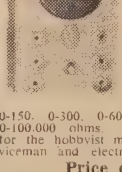

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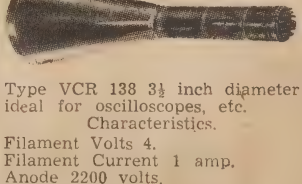

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As might be expected, the book is written primarily for the English scene, where AM sound and positive picture modulation are the order of the day. However, the discussion is sufficiently general to be of use under local conditions.

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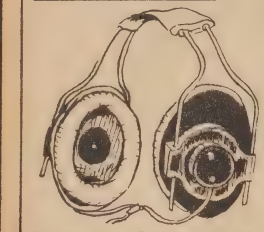

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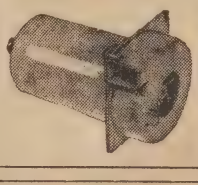

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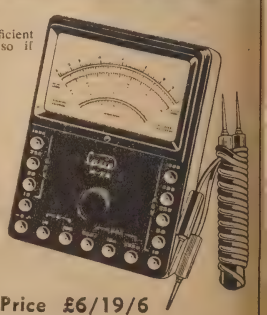

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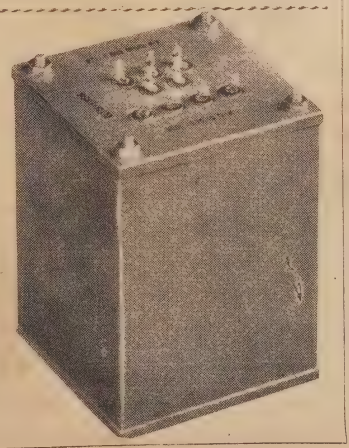

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OFF THE RECORD — NEWS & REVIEWS

The records I have played this month are many and varied, ranging from Bach to Bartok. Some of the most interesting have included music by Stravinsky, the man who did many things and none of them twice. Here we find some of his most stimulating efforts, and by contrast, one of his dullest.

STRAVINSKY — The Soldier's Tale, with Robert Helpmann, Terence Longdon, Anthony Nichols, and orchestra of seven instruments conducted by John Pritchard. HMV OALP1377.

A miniature play which is at once an opera, a ballet, and a narration. It was written by Stravinsky in 1918 and intended for a small company whose resources included few performers and instrumentalists.

The story is based on a Russian folk tale about the soldier who sold his violin and his soul to the devil in return for a magic book which produced banknotes at will. After his adventures were over —these included several brushes with the devil in various forms and a wedding with a princess—the devil claims his own and leaves the princess alone and desolate.

The recording is a studio version of the Glyndebourne performance of 1954 which took place at the Edinburgh Festival.

It is not surprising that we miss the action, for without it there are gaps in the continuity, although the narration is a big help, and is, in fact, an integral part of the whole thing.

Musically the main point lies in the skill with which the composer handles the small orchestra and makes it do so much. He has no equal when facing such a challenge.

After you have got over the mild shock at hearing the soldier's accent you will appreciate his skilful use of drama and melodrama, and Helpmann's devilish cackles as he wins his points.

The recording is remarkably forward and vivid, and altogether it is fine fun.

STRAVINSKY — Apollo Musagetes, Renard. Played by the Orchestra de la Suisse Romande conducted by Ernest Ansermet. Decca LXTA5169.

A greater contrast between styles as exhibited by the same composer could scarcely be imagined.

Renard is a fascinating and stimulating burlesque which concerns a fox, a cock, a goat and cat, meant to be played or mimed by actors or clowns on a trestle table, while their voices are given out by two tenors and two basses singing concealed with the orchestra.

Without doubt it calls for sight as well as sound to produce its full effect, but there is no mistaking the brilliant orchestration and almost absurd economy of materials.

An interesting addition to the orchestra is the cimbalom, an old instrument the purpose of which isn't immediately clear until you hear how it is used.

Otherwise this is the Stravinsky of the Petrouchka days, but with a point and sharpness not found in that earlier masterpiece, although their common authorship is betrayed by many tricks of treatment and orchestration.

Against it, we can scarcely understand how Apollo came into being at all.

It is by program a ballet on Greek mythology written in his later years for a contemporary music festival in New York, and that's really all I need to say about it.

As usual, Ansermet gives us a fine disc, and its not his fault that the minor work should walk off with the honors.

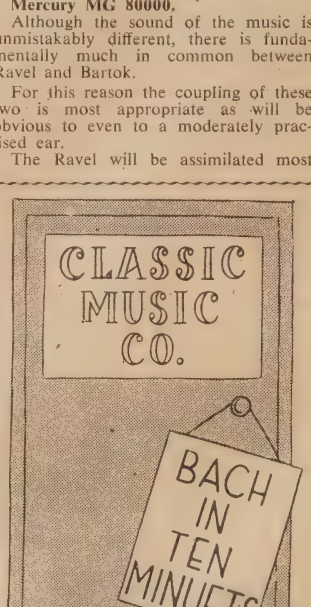
Fortunately it has enough interest to make the adventure worth while.

BARTOK — Sonata No. 2; RAVEL — Sonata for violin and piano. Played by Rafael Druina (violin) and John Simms (piano). Mercury MG 80000.

Although the sound of the music is unmistakably different, there is fundamentally much in common between Ravel and Bartok.

For this reason the coupling of these two is most appropriate as will be obvious to even to a moderately practised ear.

The Ravel will be assimilated most



easily, and sonically it is the more attractive work.

Someone once said that only a man with a nose like Bartok's could have written his scores. There's more to that than merely a bon mot—this is intellectual music, its emotions are taut and introspective, it is perfectly intelligible because Bartok's thought was clear, but it needs to be worked at by the average listener if the argument is to emerge.

It is an important work, too, for it is one of the best examples of the Bartok manner.

I haven't any other recording for comparison; but both performances would seem to be of high quality.

Both players are well known in t USA, and have played Bartok togeth for some years.

Their good team work is appare here, and the recording has helped balancing them most effectively.

But it is the interest of the music its that will attract you. It isn't backgrou stuff either—you will listen to it or y will not.

Strongly recommended as an antido for too much Brahms and Tchaikowsk

CHOPIN — Concerto No. 2; SAINT-SAENS—Concerto No. 4, for piano and orchestra. Played by Alexander Brailowsky and the Boston Symphony Orchestra, conducted by Charles Munch. RCA L16021.

Brailowsky's range of dynamics see comparatively modest when compar with other versions, although his temp are brisk and always lively.

They are not the vigorous, declam tory performances we so often hear.

This approach helps to build up t symphonic atmosphere, which can eas disappear from these comparatively e mentary scores, particularly the Chopin

Of the two, you will probably fi the Chopin the most interesting, becau it is nearly all piano, and he was mu better with this instrument than Sai Saens.

Brailowsky is a Chopin specialist, a Munch has let him take the stage almo entirely. Recording engineers ha quietened the orchestra at times almo to inaudibility.

Chopin's two concertos are amazing alike. It is almost as though he u used the same pattern for each, a even the same material with some var tions.

This was probably deliberate, for th were written at a time when he w anxious to make an impression as major composer, and probably saw reason to abandon a good thing.

It's not an ultra-brilliant performan but it is a very musical one.

The Saint-Saens has its moments, b on the whole it is an overornament and rather a dull work.

The piano is well placed and has attractive, somewhat remote air, whi I thought appropriate. Cutting amplitu is not high, but it is all very clear.

An attractive record in its class.

THE THREEPENNY OPERA, by Kurt Weill. Complete score. MGM 02-7513.

A modern version of the Begga Opera written in 1927 by two Germa which, despite its simplicity, and becau of it, ran initially for nearly five year

The English version was made America, where the opera was reviv in 1954. Since then it has caught t public imagination all over the wor and some of the tunes have becom popular hits.

It is rough, rude, sentimental, a starkly presented. Mac The Knife the pivot on which it turns. Furth

ation hardly seems necessary.
e of the singers has a voice by
standards, nor would they con-
anything if they had. The men's
are rough, and use a kind of
ation: the women's voices are
and follow the same pattern.

rkly, I don't think it is every-
record, or one to which you will
at short intervals. But no one
quarrel either with its performance
n the recording, for this is the
irl American cast, and the sound is
nd forward.

'sall here, and seems destined for
opularity.

**HOWCASE — Paganini, Moto
e etuo; Gabrieli, Sonata Pian E
o; Milhaud, Concerto for Per-
on and Small Orchestra;
ss, Serenade for Wind Instru-
s; Brahms, Serenade No. 2 in
ajor; Elgar, Pomp and Circum-
e No. 1. Played by the Phila-
hia Orchestra conducted by
ne Ormandy. Coronet KLC562.**

is a record designed to show off
ious sections of the Philadelphia
tra, which the Americans are fond
ribing as the best in the world.
oubtedly it is one of the best, but
liar qualities do not always make
most rewarding. I doubt whether
her country in the world would
a combination quite like it.

rision, power and quick response
main virtues. They have been
bed until we feel they are more
ant to the players than any others.
t other orchestra, for instance,
produce a Moto Perpetuo with
nanimous string-playing?

sl have remarked on another oc-
the violins play and sound like
ous extensions of a single instru-
t

hs, while I admire its athleticism,
chnical perfection carries its own
. The very ease with which all
difficulties are overcome seems to
with it a feeling of self-conscious-
s though the music was second-

t in most things all that an Ameri-
chestra aims to be.

Despite its lovely sound, I wouldn't
ticularly select it on purely musical
nds.

The Brahms, which is the longest
k seems a strange selection, for
t it is rather dull. For a Showcase
oint have been better to have chosen
about which there need have been
rvations.

The Elgar is tremendously effective,
ecially if you use high volume, but
s really English Elgar.

However, within these limits the re-
d achieves what it set out to do, and
eneral balance and clarity are really

**BEETHOVEN — Symphony No.
C Major, Opus 21; Symphony
o 8 in F Major, Opus 93. Played
by the Berlin Philharmonic Orches-
tra conducted by Ferenec Fric-
say. DGG 18100LPM.**

Fricsay gives probably the liveliest
formance of these symphonies on cur-
t discs.

I began with the first, and almost leap-
from my seat at the allegro burst
th

As a matter of interest I checked it against the metronome, and it clocked 126 against the mark of 112 in both editions of the score that I have

The second movement is slowed down a bit below par (as with most conductors) and the remaining movements are just a "bit on the quick side".

In general, his approach to the eighth is the same.

If you are looking for a carefully analysed performance of either symphony you won't get it here.

Fricsay refuses to believe that the mood of either symphony is very deep.

But I feel there is more grace and charm to be coaxed from them.

Perhaps the best example of what I mean is in the third movement of the eighth, which almost falls over itself in its eager pace.

So it's bright Beethoven, and that's all there is to it.

The sound is typical DGG of a couple of years back — full, maybe a little woolly under pressure, but otherwise smooth and satisfying.

The surface is good.

TCHAIKOWSKY—Francesca da Rimini, Opus 32—Capriccio Italien, Opus 45, played by the London Symphony Orchestra, conducted by Anthony Collins. Decca LXTA5186.

As a recording, this is the best of all versions. It is decidedly one of Decca's "new look", and I like it very much

I can safely use a few superlatives over it.

You will hear just about all the noises an orchestra can make, and at close quarters.

Not all of it is pleasant. I doubt whether the crash instruments were meant to be heard as soloists rather than contributors to overall effect.

And as much as I admire Decca's success in getting all this down, much as I admire the richness of the cellos, the authentic quality of the brass, and the easy recognition of what goes on, it sounds pretty noisy at times.

If you have ever played in an orchestra, or sat in the near gallery, you will know what to expect.

Collins is good at this kind of music. He is a hard driver when he likes, a lover of contrasts and strong noises, and, after all, it's no good playing these things unless you are prepared to let your hair down, not that Collins has much left these days.

The sides are well coupled — if you like one you'll like the other. Turn up the wick, and you'll be thrilled to pieces at the enormous weight and gorgeous tone.

The surface has a few clicks but mostly they are hopelessly outnumbered.

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TCHAIKOWSKY — Piano Concerto No. 1 in B Flat Minor. Played by Gina Bachauer and the London Symphony Orchestra, conducted by Alec Sherman. HMV OCLP1049.

A perfectly good, straightforward record, issued at a time when the competition is hot

its shape. It is not treated merely showpiece nor is it over-sentimentised.

The result isn't as impressive as Katchen or Cherkassky, although lower keying may be a relief to many

It has little tension — even the ing passages have no great impact, the excitement of the last movement doesn't work up very far.

The performance is well ordered. trances and exits are right on the (note the entrance of the final theme the last movement) and the sound good body. The piano is not excessi highlighted, and in many soft passa it sinks back into the orchestra in attractive, concert hall manner.

Many people like this concerto ex pretentious or showy. Those who not may well prefer the restraint of performance.

The surface is good, and the RI curve is OK.

MOZART — Serenade Ein Kleine Nachtmusik K525; Symphony No. 40 in G Minor, K550 Played by the Vienna State Opera Orchestra, conducted by Felix Prohaska Vanguard, PVL7014.

A good opportunity to collect two Mozart's most rewarding works on single disc.

On both sides the performance straightforward, played cleanly neatly, with a nice compromise betwe the extremes of style.

I liked the fresh, unobtrusive so of the strings which, nevertheless, t to dominate the scene, and which I fo the better for a little bass boost to p vide some extra body.

What puzzled me somewhat was slight rise in pitch in the last bars Eine Kleine Nachtmusik.

An interesting point made in jacket note concerns an opinion by vey that Mozart's whole musical guage is that of comic opera.

We should remember that the w "comic" here does not carry a mod interpretation. It is used to denot difference from the operas of ear times. Mozart's comic operas contai many passages of deep feeling, and less we understand the reference we easily be misled.

But, of course, not everyone agr with Professor Tovey.

CHOPIN—Nocturnes, Volume 1 Played by Jan Smeterlin. Philips AOO256L.

Were these Nocturnes meant to heard from a seat in the front row?

I often wonder whether, in record them this way, we are achieving w Chopin intended.

The Nocturnes, and the Preludes, for that matter, need some "distance" tie the notes together, noticeably in left hand, which can sound self-consci and unduly obtrusive if not kept un control. After all, its function is lar as an accompaniment.

Only the most perfect touch can k it in its place if we get too close.

s one reason I like Rubinstein's
ffort.
parison will show that the re-
cording does not deprive us of
, and avoids what can become an
ssing proximity.
bstein's extra steadiness and en-
makes Smeterlin sound over-
He is neat and obviously sin-
it has not Rubinstein's polish.
epos are generally much slower.
wever, there are many ideas about
it and there is much to admire in
ord.
ain criticism is the extraordin-
isy change-over grooves between
ce, and the short intervals be-
hem. With the remainder of
neering so good, it is strange that
ticular cut was allowed to pass.

**AHMS — Symphony No. 4 in
Minor, Opus 98. Played by the
l Philharmonic Orchestra, con-
ted by Eugen Jochum. DGG
LPM.**

recording this is probably the
ahms Fourth there is. It isn't
ite brilliant — Paul Paray gives
e sharpest sound — but it has the
al quality about it.
DGG in one of its best moods, a
mbination of warmth, well-blend-
r and firm weight.
e produce some exquisite effects.
ow up best in the quieter pass-
often described as autumnal, a
ri adjective applied to this sym-
y which many consider to be the
the four.
h I found disturbing was the ex-
ed changes in tempo, often seem-
without sufficient reason.
e moment Jochum extends the
e until it is barely airborne — the
whips it into a gallop.
ape this music can stand a cer-
mount of latitude, but it responds
appily to subtlety rather than to
ere. Mostly it is best left to play
w way.
e opening bars struck me almost as
ily for their tardiness as did Fric-
r their speed in the Beethoven
.
h. disc has been criticised elsewhere
his same point, and I feel it is a
ne.
probably a matter mainly for the
st but anyone who has heard the
k sufficiently to know it backward.
s ich extremes irritating.
o ochum's credit — the orchestra's,
hat is done is done well. and
the slowest of the slows it holds
its smooth, unfaltering line.
ou like to hear a fine combination
on" you will love it.

**IGHTEENTH CENTURY
OMEDY ALBUM — Selections
om William Congreve's The Way
f he World, George Farquhar's
e Beaux Stratagem, Sheridan's
e Rivals and School for Scan-
la Starring Dame Edith Evans.
Columbia 33OCX1384.**

e star piece of this record is
xtract from The Rivals, in which
thy Quayle as Richard Absolute
Dame Edith Evans play the first
f Act III Scene 3.
anyone who knows the play, and
n of us have studied it more or
ars ago, the delicious characteri-
ic of Mrs. Malaprop and her re-
ics to the letter in which she is so
roundly berated, are well worthy of permanent record.

Little if any below it is the dual part of Mrs. Millament and Lady Wishfort in the Way of the World to which almost all the first side is devoted.

It is a very fine achievement in histrionics to project these two parts, so different in character and age, by voice alone.

It's true that one misses a youthfulness which should be there to make the younger woman convincing, and one hears little tricks of voice which are common to all characters because they are now common to the actress, but to me they served only to emphasise how great was her achievement.

This is a completely entertaining and worthwhile disc, clearly recorded and fully articulate.

A touch of top cut to reduce the sibilants is the only comment I have to make on the engineering.

PAUL BOWLES—A Picnic Cantata with Gold and Fizdale (duo-pianists), Gloria Davy, Martha Glowers, Mereda Gaither and Gloria Wynder (vocalists), Al Howard (drums).

FRANCIS POULENC—Sonata for Two Pianos (1953) played by Gold and Fizdale (duo-pianists). Coronet KLC 506.

The Picnic Cantata is a narrative piece in which four female voices tell a story in four parts of how they decide to go for a picnic, pack the food and other materials, arrive at their destination, eat the food, read the Sudnay paper, come home, and decide they should do it again.

The text is just about as flat as that and deliberately so, for the intention is to be modern and realistic and different.

Hence the two pianos and drums.

And in truth, it has effectiveness of its kind, and will certainly delight many who like their art that way

Others may think words like this a bit ordinary for anyone to take very seriously

"The car is packed;
Have you got your hat?
Where is that map
And my driving glasses.
I hope the road
Won't be too crowded."

I don't know whose idea it was to couple this work with Poulenc's Sonata

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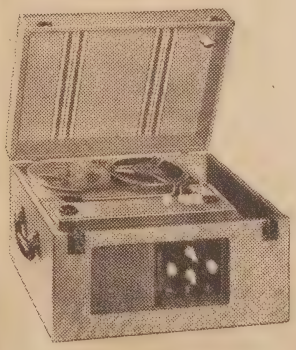

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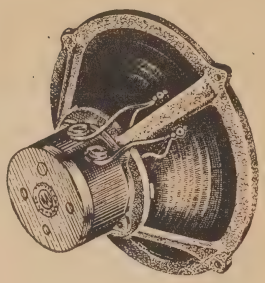

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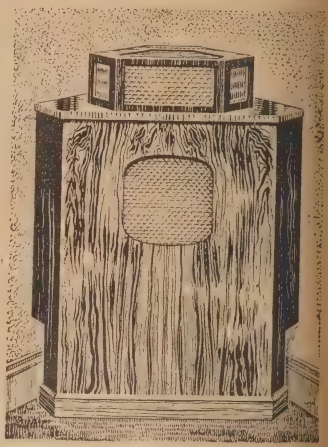

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o pianos, except that it was writ- r Gold and Fizdale the duo- ... and that both works have ial significance in their reper- e.

ought it an interesting and fas- ig piece, quite as much for the l shows in exploiting the two e as for its own charm.

his music couldn't be handled lay. It has a quality at times s quite unique, whether the extra being used to lift the size of the or whether the duplicated sec- f the keyboards are producing ombined colors of thought and

recording is good—it is interest- see that all the singers in the a are Negresses.

DGER QUILTER.—To Daisies, The Mountains, Now Sleeps Crimson Petal, The Fair House oy. Sung by Kathleen Ferrier, Phyllis Spur, piano. Decca 5-110.

is much better recording than we receive with Kathleen Ferrier. is only a hint of the roughness oilt many earlier discs, although e s no evidence that the improve- t as been due to doctoring.

h are all successful on a medium olane. All the singer's indescrib- ppeal is there. The accompani- t are adequate but not the strongest t.

N RDI — Il Trovatore with Renata bdi, Mario del Monaco, Giulietta nata and Ugo Savarese, the o s of the Magio Musical Floren- o and the Orchestra du Grand re de Geneve. Decca LXTA 6 2.

spointed out in the Italian-English k of words which goes with these ds. Il Trovatore is probably the stypically Italian opera of its period e of the most popular.

t us an impossibly tragic story from t the characters wring the last drop ony and melodrama.

There are few operas which require the same degree of lusty singing, and perhaps the best equipment for success in the leading parts is a good pair of lungs.

Monaco is already famous in this regard, and despite an obvious attempt to control his quieter notes, still retains the ability to anaesthetise us with sound.

He is only really happy when making the welkin ring, and too often produces ragged and unlovely sounds. On the other hand, only a big, ringing voice such as his could possibly make a success of the part.

LIMITED RANGE

His limited emotional range is contrasted with the greater talents of Tebaldi, who, if not a true successor to the great ones of the past, is well equipped for a fine performance. These two may even be the best team which could currently be assembled for the occasion.

The Count turns out to be a bass baritone of rather heavy quality in a continual state of strong agitation and determined to be there at the finish, which, of course, he is.

The gipsy mezzo-soprano Simionata is as good as anyone, and her duet with Monaco in the last act is a high spot and would have been even better if he had not overpowered her at the end.

For general performance and recording I can give high praise. The first ominous notes of the orchestra set a clean, spacious air and silent background which deteriorates only once for a few revolutions at the end of one side. All the voices record without strain and are particularly forward.

The score is complete with a few bars not usually included.

To sum up, this is a full-blooded Trovatore in the traditional manner, always vital if sometimes rough, and frequently very good indeed. All the high spots come off well and the engineering is first-class.

KLEMPERER SCORES AGAIN WITH BEETHOVEN

BETHOVEN — Symphony No. 7 Major Opus 92. Played by the niarmonia Orchestra, conducted by tto Klemperer. Columbia 330CX 57

Klmperer is chalking up a series of tboven successes which could easily e the field.

His first advantage lies with the Phil- nnia Orchestra, which at the ent is recording at a very high level quality.

It s good enough to place him well th front, for there is some big sound th symphony, and it cannot be heard thoo great a stature.

One again we find Klemperer's ap- an classical, careful and faithful. It th antithesis of the glib Beethoven ten hear; it has all the essential bi y which commands immediate and tin respect.

Ire are times where his immersion th music produces some ponderous ge but one seeks in vain among con- mporary recordings for a better appre- tin of the score.

Many will consider that, after a m e performance of the second move- en Klemperer could have found more brightness in the third, and even given the Presto marking a higher rating.

I at least would not like to hear this movement played any slower.

Much the same can be said of the final movement. The jacket notes refer to Beethoven's "most unbuttoned moments" said to be portrayed here.

This may be so, but Klemperer doesn't make me believe it.

Far from a movement which "charges impetuously" we hear it under extremely firm control, plenty of dynamic energy without doubt, but no lack of restraint.

Compared with Paray's effort for Mercury, he isn't even in high gear. That's an unbuttoned effort if you like! Bruno Walter for Columbia is almost as fast. Something between the two would have been about right.

At the same time, judged on all counts as a recording, this new disc must win, for it sounds best, has the finest standard of playing and is the best Beethoven.

The surface is good, balance and clarity superb and the orchestra is completely at home. Without doubt, it's one for your shelf.

MMG Mercury Records

"SLEEPING BEAUTY MERITS TOP AWARD"

Says John Moyle in the March issue of Radio & Hobbies

John Moyle also praised Mercury's First Complete Recording of Tchaikovsky's Original Score of "The Sleeping Beauty" in these words . .

"This is the third and in many ways the best of Mercury's three magnificent albums of Tchaikovsky's ballets. Musically it is beautiful, technically, it is superb and in presentation it is equal to anything here or overseas.

The Nutcracker and Swan Lake were successive triumphs which created a sensation when they were first released.

They provided me with some of the best record listening I had ever enjoyed. They were issued as luxury presentation items in beautiful albums with profuse illustrations and notes.

But they have nothing on this elegant silver production with its tasteful colored drawings by Oliver Messel.

To go through a performance like this, nearly three hours in length, and attempt to place a value on individual episodes would be a hopeless and rather futile task.

Although the recording might well have been made about the same time as the first two ballets it is, if anything, the best of the three.

It is my idea of perfect recording material. The music will appeal to everybody, mixing the romantic, the sentimental, the brilliant, the humorous, the not-too-tragic and infectious exhilaration which Tchaikovsky does so well.

His richly colored orchestration is a gift for an orchestra like this, and the Mercury touch fits it like a glove. I cannot remember a recording in which there has been more impressive sound, cleaner or better-defined brass, more delicate blending of every orchestral color and sheer, undistorted weight.

Well worth the money, I give it my highest award."

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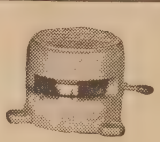

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STRAVINSKY — Petrouch Played by the Minneapolis S phony Orchestra conducted by A Dorati. Mercury MG50058.

Only a really fine orchestra and ductor can do full justice to Petrou for this music will test them, bo executants and as musicians.

One can only envy those who h for the first time.

On this disc we have a typically and vivid version, in which the gr emphasis is placed on display.

But the music is so inseparable the ballet that it suffers immediate latter is lost sight of.

Dorati doesn't entirely do this, is quite obvious that he is willi make many concessions in his sear brilliant sound.

To this end he often underlines and phrases and exaggerates dynam the detriment of the theatre.

An obvious comparison is wit Ansermet record, now about six old, but still a recording landmark

One has to play only a few pa side by side to appreciate the co and magical atmosphere that Dor often has missed—the frantic scra of Petrouchka against his prison the indolent menace of the Moo tragic brooding of the final landsca

Most of these elude Dorati, and will miss them if you take Petrouchka seriously. He is best i Fair scenes, but even here he will don his impetus to highlight an ex able bar.

But there is great brilliance heard and a more immediate sound from Ansermet. The latter shines superb balance, while Dorati's is a formance starring individuals.

Musically, therefore, I must c Ansermet, but for an electric co performance many might go for D and his electric display.

DELIBES—Coppelia Ballet Sui Sylvia—Ballet Suite. Played by Orchestra de la Societe des C certs du Conservatoire de Pa conducted by Roger Desormie Decca LXTA 5217.

One can only register pleasant app of a disc such as this. Coppelia Sylvia are probably better k through their music than any o and extracts are heard almost daily the radio, if only occasionally a certs.

These two suites are naturally en made up of such extracts. To them on one disc will gladden hearts. The sound isn't always but it is clean, airy and sweetly duced.

Mostly the solo passages are especially the clarinet, althoug thought the violin solo in Sylvia thin and reedy.

There is a good frequency range, a bias toward the top end, so that triangles, etc., are well in the pic The brass, too, deserves a special tion.

The horns at the commencemer the Coppelia, which I liked best, by way, give out with a beautiful e The mazurka which follows has a swing to it, much more so than Covent Garden effort released some ago.

A good quality disc which all enjoy.

JOHANN STRAUSS — Die Fledermaus, Annen Polka, Voices of Spring, Roses of the South, Tritsch-Tratsch Polka, Morning Journals. Played by the RIAS Symphony Orchestra conducted by Ferenc Frisnay, DGG19035 (Pol.

JOHANN STRAUSS — Waltzes; Accelleration, Adele, Emperor Polkas: Pizzicato, Persian Mobile, Tritsch-Tratsch, Champagne and Thunder and Lightning. Played by the Pittsburgh Symphony Orchestra conducted by William Steinberg. Capitol P8222.

As some one has said, the waltzes of Strauss junior are immortal, and will be for many years to come. They are always tuneful, they can and often are—played more or less successfully on almost any instrument or combination of instruments. When a good orchestra gets hold of them they are often magnificent.

Of these two I am afraid the RIAS version comes the nearest to mag-nificence.

It is more remote, but has more size, than the American orchestra, which is rather strange, as this effect is more the art of recording than anything else.

The one in "Thunder and Lightning", which we could expect some dramatic effect as the sound seems to fall rather flatly not usually a failing with American bands.

In any rate the two discs are not very competitive. Capitol's has nine items as against six, and only one items are duplicated.

And if it's Strauss that really sounds like Strauss, the DGG has it in a recording which plays best if you can turn the wick a little.

The surfaces are good.

TCHAIKOWSKY — Symphony No. 6 in B minor Opus 74 (Pathetique). Played by the Concertgebouw Orchestra conducted by Paul van Kempen. Philips N.L. 10253 L.

Well it is a very brilliant disc from start to finish—it sounds probably the most impressive of all the Pathetiques. Mind you I have not yet heard the new Leningrad version.

But Kempen pushes his orchestra hard, and they respond like the musicians they are, rarely letting him down.

And yet I did not feel they had entirely attained the mood of this symphony. I use the word advisedly, for I hear the full cycle of sadness and despair. Nowhere else has Tchaikowsky expressed himself so successfully and so directly set down his troubled mind.

There is a very forward recording for the brass and sometimes the instrumental groups separate out for the microphone when they should be massing to convey home the tragic mood Tchaikowsky strove so unashamedly to do.

The high pressure, in the first movement for instance, certainly gives an overwhelming sphere of wild unrest, but it doesn't quite hide the full poignancy with which the music is loaded. Even in the second movement sorrowful, but not really sad.

And in the last does van Kempen reach full intensity—more telling than all the others put together.

Elsewhere his tempos are on the slow side.

Remarkable contrasts are found by comparing the treatment of the first subject of the first movement as presented by Fricsay of DGG and Kleiber of Decca.

Fricsay, particularly, makes this a marvellously eloquent passage. Van Kempen sounds more like an impatient motorist who has just received the green light.

That fortissimo chord in the middle, signalled from a mile off, arrives like the axe that the chicken received. A thunderbolt should fall with less arrangement than this.

But if you like dramatic Tchaikowsky not too heavily handled, it's probably just what you want.

It is, for Philips, a hi-fi disc, with a new-look clarity and precision. If anything it's a bit on the thin side—violins slightly edgy wood-wind, etc., well to the fore—and light on middle and lower strings, giving it less body than the best.

J. S. BACH—The Six Brandenburg Concertos (original instruments and score) played by the Hamburg Chamber Orchestra conducted by Wilhelm Schuchter. Parlophone PMAO 7002/3.

I'd like to be more complimentary about these discs than I honestly can be, for any complete recording of such beautiful work deserves commendation.

Actually they are rather hard to do well. So much depends on the interplay of instruments, which varies in a fascinating manner through the whole six concertos, that today we should expect to hear the very best combination of ensemble and individual color.

I must be honest again, and say that most of the versions of these concertos I have also fall from grace in many respects, and it is quite remarkable to hear how different the music sounds on each.

Some use ordinary flutes instead of recorders, others seemingly omit the harpsichord or render it inaudible, or their trumpets don't sound properly, and so on.

Only in a couple of Westminsters of the London Baroque players released some years ago will you hear how clearly it is possible for all the instruments to sound on a record, and to realise how vitally their balanced presence affects the music.

I don't think this new release was recently recorded, for the sound has a general air of remoteness which, although pleasant in its way, covers up far too much detail.

I noted a number of points with approval, among them being that very special trumpet tone used by Bach—its insistence in No. 3 for instance leads me to suspect that someone is very proud of it.

But the harpsichordist seems to have gone home in many places, and the recorder flutes make little of their opportunities, although we can at least be thankful that they are there.

It is good honest work which many will like, but which does not rate above average when it is all added up.

The surfaces are good, and to get all six concertos on two discs so brightly played is a good buy.

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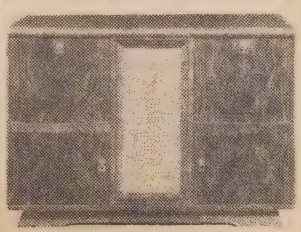

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SHORT-WAVE NOTES BY ART CUSHEN

SOME NEW SHORT WAVE STATIONS

Many new stations under construction, increases in present power, and changes in frequencies, are featured from stations throughout the world this month.

THE Philippines are the scene of much radio activity these days. We recently gave details on the new 100 Kw transmitters of the Far East Broadcasting Company in Manila, and this month brings news on two more stations in this area.

The National Council of Churches from its American Headquarters announces the installation of 100 Kw transmitters on both medium and short wave to carry the Gospel message to listeners in the Philippines, China, Pakistan, India and Indonesia. The station is to be located at Dumauete City on Negros Island.

Cotabato on Mindanao is the location of a new Catholic radio which operates on both medium and short wave. The short wave transmitter is DXB3 and operates on 3945 Kc.

VATICAN CITY is to open a new transmitting station at Ponte Galeria. It is expected to be completed by June, during which one medium wave and two short wave transmitters are to commence operation.

BELGIAN CONGO stations which transmit from Leopoldville, have a revised schedule released by Radio Australia.

Radio Congo Belge, operates its first transmission for Europeans and educated Africans from 3.00 to 4.30 pm, Sundays 3.00 to 5.00 pm, using 9380 Kc with 50 Kw and 6160 Kc with 20 Kw; 8.15-10.30 pm on 11720 Kc, 50 Kw and 4760 Kc 20 Kw; 3.30-7.00 am (to 8.00 am Sundays), on 9380 Kc 50 Kw, 6296 Kc 250 w. and 4760 Kcs on 20 Kw. Listeners in the Belgian Congo are provided with a service from 8.30 pm-10.00 pm on 11670 Kc and from 2.30 to 5.00 am on 9210 Kc, with 50 Kw.

MONROVIA station ELWA, broadcasting from this city, the capital of Liberia, has been conducting tests to North America during February, and announcing that a service to this area would be commenced in March. The station, operated by the West African Missions, uses several frequencies, including 15200 11787, 11800 and 9670 Kc, at various times during the early afternoon. The transmissions were heard by Ausgust Balbi, of California, who reported that only one channel 15200 Kc could be considered as suitable for the transmissions at that hour, jamming being troublesome on the other frequencies. We in this area receive ELWA on 4835 Kc at 4.45 pm when conditions are suitable.

RADIO FREE EGYPT is reported by North American listener, George Cox, of Delaware, as operating on 15136 and 17787 Kc. The station has been heard at 1.40 am when the programs have been in Arabic. The 16M band station has been noted to vary in frequency slightly in this transmission.

AFRS schedule

THE schedule for the winter broadcasts from the Armed Forces Radio and Television Service, Los Angeles, includes the use of the 13 metre band for transmission. The stations of AFRS operate 11.15 am-12.15 am. The full schedule of the programs broadcast are available from the AFRTVS at Hollywood 38 California. The transmissions are carried as follows: 11.15 am-4.00 pm on 15315 Kc; 11.00 am-5.00 pm on 21630 Kc; 5.30 pm—12.15 am on 9700 Kc; 11.15 am-5.00 pm on 17850 Kc; 5.15 pm-12.15 am on 11870 Kc; 11.00 am-4.15 pm on 15130 Kc; 4.30-10.00 pm on 9570 Kc; 10.15 pm-12.15 am on 11710 Kc and 11.00 am-5.30 pm on 17770 Kc. The program content will be slightly altered after April 28 when USA goes to Summer Time but the transmission time of 11.00-12.15 am will remain unaltered. News is broadcast every hour on the hour except at 2.00 pm and 9.00 pm when baseball games are in progress.

Brazilian on 9620 Kc

A NEW Brazilian has shown up on 9620 Kc and it has been identified as ZYR96. In Sao Paulo. The station opens at 7 pm when a clock chimes six, and the rendition of Large with news in Portuguese follows. The chimes are also heard at 8 pm but at this time signals have faded. The station uses 10,000 watts and has the slogan Radio 9 de Julho Sao Paulo. The station operates 7.00 pm-1.00 pm, and reception is best for the first part of the transmission. There is some side interference from the Canadian CKLO to 7.15 pm in their service to the South Pacific.

HLKA using 9460 Kc

THE Korean Broadcasting System at Seoul, Korea, has been noted on the frequency of 9640 Kc by Victorian listener Ron McEwan. The station has been using the call sign HLKA, and opens on the frequency at 9.30 pm when reception strength was fair and by 10 pm had improved to good strength. On Friday night an English Korean lesson has been noted. The program material on this new frequency was found to be different from that carried on 7935 Kc the present HLKA channel. It would appear that an additional transmitter is on the air, and a check on signals finds that, at 8.30 pm, when English is carried on 7935 Kc, the signals are good, but fall off in strength at 9.30 pm, when signals on the 9640 Kc improve. Thus it would appear that a change of transmitter is made at 9.30 pm. The other HLKA channel is on 2510 Kc and signals on this frequency are fair after 9 pm, with light side interference from the WWV Frequency Check Station on 2500 Kc, located at Washington, DC, USA.

Our readers report

INTERESTING items from readers to this page indicate some new stations which they are hearing.

Our West Australian correspondent Cyril Anderson, Mt. Hawthorne, has been hearing the Mafeking transmitter on 5900 Kc to sign off at 5 am. The station uses the call sign ZNB and has been logged from as early as 3.00 am. The frequency is notorious for interference from Morse stations and it was only through a break in this that a clear picture of the program was received.

Norway has been heard in a special program beamed to the Far East, Japan, Australia and New Zealand, and is using 25900, 21670, 17825 15175, 11735 Kc. Our reporter Kevin Dunham, of Narrandera, NSW, reports that the program is composed of news talks and short interval of music, and is in both Norwegian and English. The best frequency in his location

Notes from readers should be sent to Arthur Cushen, 212 Earn St., Invercargill, NZ. All times used are Eastern Australian Standard.

is 15175 Kc as the others are either jammed or suffer side band interference.

Rome, Italy, has been the centre of listening for some weeks by Miss Pamela J. Gwin, of Fernhill, NSW. She submits the latest schedule of the station, which has the address of Box 320, Rome, Italy. The session 7.00-7.15 pm comprises news bulletins an music, and the signals are best on 21560, 17800, 11910 9575 Kc.

ISRAEL transmissions from Tel Aviv are reported by Bill Hawthorne, of Victoria, to be released on the new frequency of 9555 Kc. The station was noted at 7.30 am when carrying the Voice of Zion broadcasts.

PERUVIAN Radio Sol Del, Peru, broadcasting from Lima has been noted on the new frequency of 15455 Kc to sign off at 4 pm. The station has been on the 19 metre band for some months using 15190 Kc but the new frequency has given better reception here. There is some interference from the Brazzaville station on 15450 Kc while the nearby BBC frequency of 15447 Kc is also in use.

FLASHES FROM EVERYWHERE

CAIRO has been heard in this area in 19 metre band outlet of 15375 Kc. The was noted opening at 3 pm with the clock chimes and anthem, was follow a program in Arabic. The same freque also heard at 6.30 am during the Engli transmission to Europe, also carried on 9

ANGOLIAN station CR6RG, operated Diamong Company at Dundo, is repo Cyprus as using 9340 Kc when signals ho at fair level at 4 am to sign off at 5 The station broadcasts in Portuguese identification just before the sign off, program content is made up of classic popular music.

COSTA RICAN station Radio Excelsi been heard in North America on the quency of 6525 Kc broadcasting from the San Jose. The station has been heard pm when identification is given in Engli Spanish.

JOHANNESBURG, using the frequen 7229 Kc, has been heard with English n 3 pm, the transmission commences at 2 Reception of this frequency in this are ticularly in New Zealand, should be in the winter, providing the amateur ence is not too severe.

WINDWARD ISLAND, which has bee fied in the 16 metre band, is now using Kc in the daily transmission from 7.00 12.30 pm daily. The 17805 Kc transmis only 250 watts. The other frequencies a and 3395 Kc and the latter channel is e to be changed to either 4760 or 5020 K 5000 watts. It is then expected that the will either be dropped or beamed in a d direction.

KENYA transmitter ZHW6 has taker the channel of 4800 Kc recently vacat Lagos, and the transmission from Kesuma station operates 1.30-2.30 pm and midnig am and on Monday the sign off is at 3.0 The station identifies as "The African casting Service, Kasuma" or the West stat the African Broadcasting Service, repor Cyprus correspondent to Radio Australi The station carries BBC world news at daily except Monday.

TANGIER transmitters which are now what numerous, have mainly transmissions ed to Europe and in particular Scandinavi Radio Tangier station has been heard ov past few weeks conducting a test transm to Sweden when the frequency of 9325 used. Signal strength in this area is goo a recorded announcement each three m asks for reports and gives a Swedish address. We suggest that you send your to Radio Tangier, 33 Goya St., Tangier. test broadcast has been heard from as ea 5.30 am to after 7 am.

LEIPZIG is operating on 9730 Kc wi English transmission at 6.30 a.m. while Aus listeners are also hearing the later cast on at 8.30 am. The station provides signals during the earlier transmission which being carried over the Berlin stations East German Republic on 7150 and 611 The Berlin transmission on 7150 Kc has b been verified by the writer. The confirming fication card showed a photo of one Berlin streets, with the verification deta German on the reverse side.

The transmitting site for the well known broadcasting station HCJB "The Voice of Andes." The station uses six transmitters and provides a continuous series of religi programmes, in several languages, both on broadcast and short-wave bands. studios are about fifteen miles distant and are connected to the transmitting by high frequency FM links. A television outlet is planned for the near futu

TE HAM BANDS WITH BILL MOORE

ny WIA groups of Radio Amateurs throughout Australia are planning their future work . nsure some activity in the International Geophysical Year programme. News of one section includes planned observations of the movement of the Earth's satellites.

'Y' sub-committee of the NSW VHF comprising Phil James, VK2ER, John K2ANF, and Jim Cuming, VK2ZBD, active forming plans for observations f the Earth's satellites to be launched to September of this year.

co-operating with the Amateur Astro- sociation who hope the sections' ob- will give them one minute's notice of e's approach to the meridian it will

intention of the section to arrange ting up of observing stations to record of the satellite and time of arrival

ports that a number of satellites will be und will take 100 minutes to encircle The transmitter will operate on 108 a few milliwatts input. A survey on ency is being made around the world if it is free from the stations. Powered batteries it is anticipated the trans- will have sufficient energy for over one eration.

tails of radio amateur activity in the ject will be published as news becomes le

Amateurs and TVI

ST radio amateurs are gratified to note ano few reports of amateur caused TVI en recorded. Fortunately few TV re- are being installed in fringe areas ere for instance some TVI has been e but generally up to 50 miles or so at ably clear location, TV transmissions re received at remarkable strength.

e VI has been experienced around Syd- ne suburbs and the same position is ob- Melbourne.

Many with their own TV sets f our number with their own TV sets liberately operated their transmitters t worst conditions to check possible TVI e the transmitter is adjusted normally alongh the unit has not been specially roped. very little interference was re- In one case when the frequency range ugh to 28 Mc/s was covered.

erally it appears we have been over pes- ion the effects of our current trans- s in TV pictures. Naturally much de- the actual transmitter in use, how it o-ructed, etc. Our concern was natural ew of overseas experience. Possibly the ge input of the 1 Kw permissible in was the main contributing factor to n hat country.

e ar mere 100 watts allowable input must assist to reduce any possible TVI. To offset any over-enthusiasm we also remember that TVI has been difficult to remedy in many cases in the UK where the maximum licensed power input is 150 watts.

Possibly the receivers on the Australian market are of superior design to those in the UK and this factor is assisting VK amateurs. Only time will provide an accurate assessment of the impact of TVI problems in this country

Transmitter for 2WI

Official WIA transmitter for the NSW Division is now being operated from its new "home" at Dural and since mid-March high-power units have been in use. Excellent State-wide coverage is being obtained.

Only temporary antennas are in use with 300 watts input and utilising the 3.5, 7 and 144 Mcs bands VK2WI transmissions are certainly effective.

The amateurs who worked hard on the project are glad to see such results for their efforts. VK2WI stands as a monument to those who gave so much of their spare time for such an effective service to amateur radio.

At a date in May yet to be fixed the VK2WI building will be officially opened by the Minister of the Interior, Mr. A. Fairhall, VK2KB. Full publicity will be given on the opening over VK2WI and through the Press.

VK2WI transmitters housed in such an ideal location should serve a two-fold purpose, firstly to disseminate news of the WIA and amateur radio activity generally and secondly as a base control station for WIA emergency net operation during flood and fire and for civil defence communication work.

Lecturer at the March meeting of the NSW Division of the WIA was Bob Ridgley, VK2ZAR, his subject VHF transmitters. Bob produced some of his finely constructed equipment which was the subject of many complimentary remarks

Hunter Branch officials

THE annual meeting of the Hunter branch of the NSW Division of the WIA was held in March and State President Jim Corbin, VK2YC, journeyed to Newcastle to attend. The following officers were elected for the year 1957-58; President, Lionel Swain, VK2CS; Vice President, Stuart Fairhall; Secretary, Chas Archbold, VK2ARV; Treasurer, Bill Hall, VK2XT; and Zone Correspondence, Les Sparkes, VK2AOR

VHF overseas

EUROPEAN and North American stations have been enjoying the current excellent propagation conditions by making many cross-band 28 to 50 Mc/s QSO's. G5BD for instance has recorded 80 contacts with North American stations who were operating on 50 Mc/s in just over one month. Call areas were as follows: W1, 2, 3, 4, 5, and 8 and VE1.

Hundreds of W and VE stations have been heard in Europe on the band. Television signals from Russia on 49.25 and 56.25 Mc/s have also been received in the UK.

Amateurs on 70MC

FURTHER news of interest on the VHF spectrum is that additional countries in Europe are permitted to operate in the region of 70 Mc/s.

EI—Eire stations may use the allocation 70.575 to 70.775 Mc/s in line with the new G allocation.

YU—Yugoslav stations have been granted an exclusive band from 72 to 72.8 Mc/s, a concession only available to French and Russian amateurs.

Southern Rhodesian amateurs have also received permission to operate in this region, from 70.26 to 70.4 Mc/s.

DX operation on 50 Mc/s due to F2 layer reflections has been very extensive during the last four months. In addition to the interesting crossband 50 to 28 Mc/s working between Europe and North America, another East-West path from Japan to the west coast of America has provided hundreds of contacts. With the MUF on occasion above 51 Mc/s one Japanese listener reports receiving on one day 16-W6's 15-W7's 1-VE7, and KX6BQ, some amateurs tallying 10 and more contacts in the same period. An idea of the DX worked can be obtained from the 50 Mc/s WAS rating in QST.

LU9MA has, for instance, worked stations in 16 of the 48 US States. PZ1AE 15, and during the recent openings JA1AUR has contacted amateurs in five different States in western USA. At the moment 18 W stations have contacted all 48 States on the 50 Mcs.

In March it is anticipated north-south openings will occur (east-west contacts will be limited) and US amateurs hope to work into South Africa during the period.

Another outlet for US VHF group activity proving popular is 144 Mcs working during meteor showers. The intense heat generated during the progress of meteors through the upper air leaves an ionized trail 30 to 100 miles above the earth. 144 and 50 Mcs signals reflected from these trails during meteor showers provides unusual DX conditions, with contacts up to 1300 miles being recorded on 50 Mcs.

On occasions the signals are reflected long enough for a complete exchange of reports. Generally they are received for only a short period although 80 3-minute bursts were recorded.

Naturally such operation does not provide much opportunity for rag-chewers but extends a challenge to those of our number interested in working in an unusual field.

DX and overseas

EVEN some of the big guns in the DX sphere leaders on DXCC Honor Roll had trouble breaking through the pile-up on VP2VG operating on 14 Mcs and located in the Leeward Islands. During the Sunday afternoon it was a perfect example of the futility of stations massing on the one frequency. A few tempers be came frayed during the fracas.

HR1BE, QTH unknown, was another station receiving attention, some excellent prefixes are being received on 14 Mc.

Stan, VK9AD, from Norfolk Island, has been adding some interest to telephony working on 3.5 Mcs—a little DX flavor. The crowd awaiting contacts was quite a large one.

The final weekend of the CW section of the ARRL DX contest showed that the exponents of 3.5 Mc DX will have to wait for a few years before they enjoy regular band openings.

A number of W's were contacted by VK contestants but signals were weak and static level high. The higher frequency bands were open around the clock but again it was difficult to pick out competitors from the general activity.

Stan Herbert, G3AFU, in his "Month on the Air" feature in the RSGB Bulletin makes some very interesting observations on the impact of commercial interference on the amateur bands.

He points out that DX signals on 7 Mcs

ustralian Amateurs Active on VHF Bands

2 SW VHF section's 144 Mc/s Autumn ic Day held in late March was excep- ly well supported and messages were ed from many stations located over a ea of the State.

ction covered by the amateurs competi- ng approximately 200 miles by 500 miles. m from Albury in the south to Armi- e Grafton in the north and from the t Forbes and Coolamon in the west.

ne stations participated in the event th VK2HO/VKTAPQ combination handled eages.

particular message originated by Don ert, VK2RS, of Albury, travelled some nes in three hops to Noel Hanson. AH, at Mt. Ebor, near Armidale. The stdistance contacts established were be- H2ANF Bell, VK2ZBD Katoomba. Mt. Tooty, VK2OA/TAFM Mt. Wilson sed in the Blue Mountains, VK2AHH Ebor and VK2ZAA Kendall.

country amateurs operated from their TH including VK2RS Albury, VK2AJO arn, VK2WH Forbes, VK2JW Orange. D Blayney, VK2PN Jumut, VK2VU Single- VK2ANU Muswellbrook. VK2NY Grafton 20 stations in Sydney and suburbs also g during the contest.

ost-country links on 144 Mc/s were opened ree stations working at home, especially ree VK2ANUand VK2VUU to stations in ver, the path across the Blue Mountains AH was heard by both VK2HE and E 220 miles over a difficult path. he March evening hidden 144 Mc search of the section again proved a win for secretary Bob Winch, VK2OA—it's getting monotonous Bob—he was the only competitor to arrive on the correct side of the Georges River within the specified time. There was only two minutes to spare. The transmitter was effectively hidden by VK2AFM and VK2APQ.

The VHF section of the NSW Division is now known officially as the VHF and TV group of the WIA NSW Division.

VHF IN SOUTHERN STATES

The southern States Victoria, Tasmania and South Australia's VHF gangs in February and March featured prominently with their extensive interstate working. Contacts were established between all three States on 144 Mcs. The propagation conditions allowing these contacts did not appear to have extended into NSW. Amateurs in this State closely watched the band but heard nothing in the way of unusual or long distance signals during the period.

The VK4 VHF group's monthly hidden transmitter hunt conducted in March was run during the evening hours. The transmitter was positioned by the February winners Les, VK4ZAB and John, VK4ZAG, and they selected a site on a hill near Upper Stafford.

Winners of the March hunt were Jack, VK4JO ably assisted by Lou and Tom. In second place was the Ipswich gang Ross, VK4ZAT, Brian VK4ZAP and Rick, VK4VR. They travelled a long distance to participate.

Watch those beams, chaps, as on the the law of averages we should see a cyclone shortly. Jack, VK4JO's 16 element job was damaged recently by high winds.

The above VK4 notes were contributed by John, VK4ZAG.

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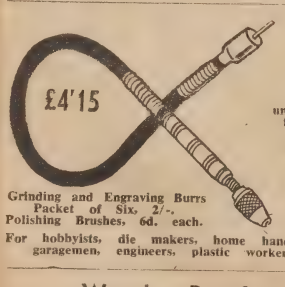

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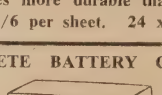

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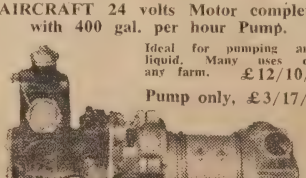

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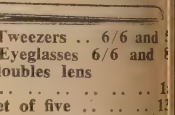

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ZS, VS1 and VU are seldom heard, the corresponding period in the last cycle hundreds of these stations were during the evening hours in Europe. Amateurs here in VK no longer chase the mornings on this band, commercial are mainly from broadcast stations is far

first 50 Kcs of the band there are vacant spots and to make an early DX contact it is necessary to delve barrage of interference.

tly there is no ready solution to the of these intruders in our exclusive ama ations.

ght spot also mentioned in the feature Pakistan Radio who operates on 7010

ing to Arthur Milne, G2MI, the Admini that country has given an undertaking 7010 Kcs transmission will be discon soon as a vacant frequency is found

ile transmissions will be limited to two rom 1245 to 1320 and from 1600 to s GMT. For many years now Radio has been the strongest of the offending ions.

Some new calls

Amateur calls that will soon emanate Antarctica will belong to members apanese and New Zealand expeditions proceeded south to establish their IGY

will be located at Prince Harold Land ate 7 through 21 Mcs. The NZ stations ZL5 and include ZL5AA, 5AB and

near future the subject what really s a country for DXCC counts in Ant will be investigated. With so many of different countries active from there, islands, some from the Continent, it difficult to assess.

0.1 is located on Wrangel Island and heard on 7 Mcs and UA0FKC operates khalin Is. It is reported that UP0L12 soon Wrangel.

innovation heard on the HF bands is orking from 14 to 28 Mcs. TI2HP on has been heard working a number of ZL's on 28 Mcs. Both sides of the could be heard via TI2HP. It appears very successful method of creating un interference, strictly illegal too; hope is forgotten once the novelty wears off.

4 in the Cayman Island produced much n the DX field during the station's opera February and March on several amateur

visitors from the Ohio Valley Amateur ssociation manned the station to permit around the clock until they closed ort on March 27. QSL cards for contacts he period should be sent to W4KVX unning the QSL side of the operation.

QSL bureaux

Latest addresses of ARRL QSL Bureaux ering all amateurs in the US, its pos and Canada are as follows. Cards for in these areas can be directed to these

1 K1—D. W. Waterman, W1IPQ, 99 Flat d., Easton, Conn.
2 K2—E. F. Huberman, W2JIL, Box 746, rooklyn 1, New York.
3 K3—Jesse Bieberman, W3KT, PO Box lia-Cynwyd, Penna.
4 K4—Thomas M. Moss, W4HYW, Box unicipal Airport Branch, Atlanta, Ga.
5 K5—Robert Stark, W5OLG, PO Box 261. one, Texas.
6 K6—Horace R. Greer, W6TI, 414 Fair nst., Oakland, Calif.
7 K7—Joseph P. Vogt, W7ASG, 5399 Karen lem, Oregon.
8 K8—Walter E. Musgrave, W8NGW, 1245 8th St., Cleveland 10, Ohio.
9 K9—John F. Schneider, W9CFT, 311 W. v., Warsaw, Wisc.
0 K0—Alva A. Smith, W0DMA, 238 East t., Caledonia, Minn.
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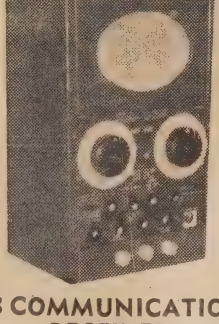

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6.3V 6.3V 215V 4V **£4/5/**
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12 volt operation
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Crystal frequency conforms to PMG requirements for small ships and other services.

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15 valve. 2 to 8 meg. 250 meg. Complete with valves. 12V Power Supply & Circuit.
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Miniature telephone units to suit. Hand sets or H & B 10/-

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New condition complete with valves makes excellent 6 channel TV tuner

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New Coils and Intermediates standard or miniature to suit all valves.

Coils B/C 455 KC	9/6
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Input	Output		
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12V	500V 350MA	£8	10 0
12V	1200V 200MA	£6	10 0
6V	500V 150MA	£6	10 0
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12V	300V 250 MA	£4	10 0
12V	235V 50 MA	£2	15 0
12V	350V 50 MA	£2	15 0

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NEW BENDIX GENEMOTORS

24V in 230V 100 MA OUT

£1/5/-

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ENSITIVE RELAYS

Operates on 3 Volts S.P.D.T.
Keying, Modellers. Alarms etc.
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Complete with Shield and Socket

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15 valves. 2 to 8 meg and 250 meg plus intercom.
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Suitable for TV or CRO. VCR. 97. VCR. 138. CV1112

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IDEAL FOR Q5ER

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811	1 2 6
829B	3 15 0
100TH	2 10 0
866	15 0
217C	12 6
807	12 6

A.C.E. RADIO

Amplification Communication Electronics

PHONE LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W
AND 636 KING STREET, NEWTOWN

EVENINGS and WEEKENDS: "KALUA", COLLAROY ST., COLLAROY — XB59
DULWICH HILL, UNDERCLIFFE, EARL WOOD, TRAM AT DOOR, STOP No. 42

T.V. — YOU Can Build It!

Described in this issue is a T.V. set capable of performing equally as well as the commercial units. There is no reason why you cannot get a similar performance with a home constructed unit, and save £50 to £100 in the process. There are a few details that it is essential to keep in mind. (1) Layout and parts placement are of great importance, do not change it. (2) good earthing and the shortest possible leads are essential. (3) do not attempt to economise by using reduced filter capacity, or second hand resistors and condensers. (4) Commercial tuners and I.F. strips are now readily available at prices comparable with the cost of parts to make your own, they are pre-aligned and tested, it is very unlikely that you will have access to test equipment suitable to perfect your own make. Most makes of tuners and strips are interchangeable, the only modification necessary would be to the input transformer primary, or to the tuners transformer secondary. (5) it is advisable to consider your T.V. set as five separate units, each being capable of being tested as a unit to simplify fault finding, and complete each section and test it before starting on the next section. In the following order, (1) power supply. (2) tuner and I.F. strip, test through pick-up terminals of any radio set for sound. (3) video amplifier and vertical and horizontal oscillators and outputs, A.G.C. etc. and check on CRO if available. (4) the E H T supply and connections to picture tube. Finally the audio end and here you are on common ground where you can really go to town and turn out something really superior to the present line up of commercial sets.

MAKE USE OF CHANNEL 3

A 1 valve oscillator tuned to aprox. 87 or 98 megs and placed near tuner or turret and set your turret or tuner on channel 3—the performance on the F.M. station will really surprise you.

TECHNICAL SERVICE AND ADVICE

Whatever your problem or difficulty in T.V., Radio or Amplifiers at any hour or any day, we will be happy to assist you by phone at the above No.'s.

T.V. ALIGNMENT SERVICE

Provided your wiring appears satisfactory, we will provide alignment service. We have the equipment and most important the know-how.

T.V.

KIT SET AS PER R. H. & T.

with tested Steans I.F. strip and Philips o Astor turrets. 17in tube.

PRICE APPROX. £125

COMPLETELY WIRED & TESTED .. £14

AS ABOVE FOR 21in TUBE KIT

£140

WIRED & TESTED .. £15

Kit for 6in tube with tested strip and 3 channe tuner .. £75

WIRED & TESTED .. £8

TURRETS, PHILIPS, OR ASTOR

£19/15/-

R.C.S. 3 CHANNEL TUNER KIT

INCLUDING CIRCUIT ..

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WIRED & TESTED WITH VALVES £9/17/6

VIDEO & SOUND I.F. STRIPS

To identical circuit and components as used in R.&H. T.V. set.

Using Octal valves £17

USING MINIATURE VALVES .. £21

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Amplification Communication Electronics

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ic wave, bass & treble boost
d R.F. stage 12" speaker.

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vlve also available as home
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C to 16 meters and broad-
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vlve 6 volt 10 watt **£18/15/-**
vlve 12 volt 10 watt **£19/15**
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HI-FI RANGE MULLARD 5/10.

£34'15'0

plete with Jensen twin cone
aker, Ferguson O.P. trans-
her, 301 & U.L. taps.
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Dual wave, 6 valve radiogram chassis includes bass & treble boost, 12" Jensen or Magnavox speaker.

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Formers in cans with special V.H.F tuning slugs and winding data for video and sound I.F.S. and traps . . 6/6 ea.
E.H.T. Transformers for 3000v £1/15/-ea
5000v insulation Fil Transformers £2/-/-ea
Video and sound I.F.S. ratio detectors and traps to A.W.A circuit specifications Pre-aligned 19/6ea
Wired and tested video and sound I.F strip with traps and ratio detector including valves and circuit. Including valves £21/-/-
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N.B. All equipment complies with P.M.G. specifications.
Turrets, line transformers, yokes, deflection coils and standard 17" tubes available.
Also first class technical and alignment service.
Coils and IFS etc. Including chassis and sockets and circuit for Steans video and sound strip £6/10/-

3 SPEED PLAYERS

All makes from

£11'17'6

3 SPEED CHANGERS

£15'17'6

Portable carrying cases, £4/17/6, Players. Changers. £6/15/-

6 VALVE R. H. & T. KARSET

Complete Kit including Aerial & Installation Equipment

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Completely Wired & Tested

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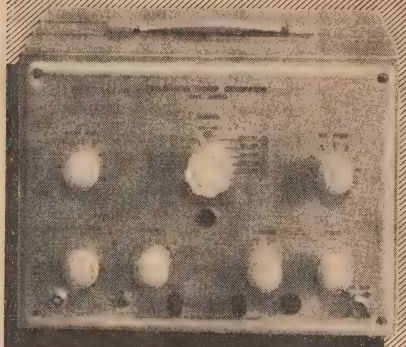

A.W.A TELEVISION SWEEP GENERATOR

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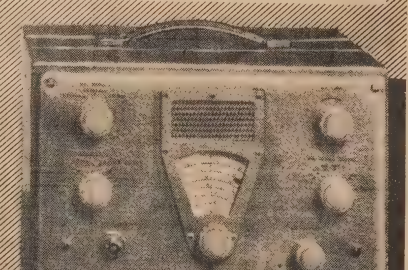
For visual alignment and trouble-shooting of TV tuners, sound and picture i.f. amplifiers, trap circuits, and video amplifiers. Has pre-set switch positions for all VHF TV channels; continuous tuning from 50 Kc. to 50 Mc.; high output voltage flat and free from spurious responses. Fundamental signals generated on all channels by push-pull oscillator.



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This versatile instrument supplies a fundamental frequency r.f. carrier of crystal accuracy over the range of 19 to 260 Mc. Built-in crystal calibrator, heterodyne detector, amplifier and speaker provide 96 crystal calibrating beats over the entire range, which is spread over a dial-scale length of 144 inches. A built-in 5.5 Mc. crystal is provided for alignment of intercarrier i.f. amplifiers and discriminators. Provision is made for displaying horizontal and vertical bars on the TV receiver under test.

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

Sydney Melbourne Perth Wellington, N.Z.

6S11.57

The Fundamentals of Tuned Circuits

(Continued from page

speak of impedance rather than ance.

At its resonant frequency, a tur cuit has an OSCILLATORY Assume, in figure 6a, that the ca is disconnected, charged from a then instantly connected again coil.

The charge across the capacitor immediately commence to leak initiating a current through the in and, in so doing, it would build magnetic field around it. Imme the charge disappears, the initial would cease, causing the magneti to collapse.

OPPOSITE CHARGE

Even as it collapses, howeve magnetic field maintains the curre to the point where the capacito comes charged again in the op polarity. Then the capacitor would to discharge in the opposite di and the whole action would be re again and again.

In practice, some of the energy in each ALTERNATION, and the latory action ultimately comes to a The result, illustrated in figure known as a damped train of wav is important to note that the n period of oscillation of a tuned corresponds to the resonant freq where the reactance of inducto capacitor are equal.

From an inductor and capacit fixed value, there can obviously b one definite and fixed resonant freq However, as we shall see later, design frequently calls for tuned c whose resonant frequency is capa adjustment within certain limits.

VARYING RESONANCE

In practice, this is achieved by ing either the capacitance of the denser or the inductance of the co the two methods, the former is the usual (figure 8a), and it is for ju purpose that the variable condenser trated in the last chapter, is empl

Variation of inductance is less mon, but can be achieved by alteri physical relationship between two of a coil, or by inserting or with ing a metal core through the cen the coil former, thus acting direct the magnetic circuit.

It is worth noting, in passing, a resonant effect is also apparen tween an inductor and capacitor nected in series (9a). The reactan such a combination reaches a min value at resonance, as is illustrat figure 9b. In later chapters, we sha just how these various combinatio resistance, inductance and capac are employed in actual receiver cir

---

A PROPOSED noise elimin system in Boeing's new p use a microphone and amplifi pick up noise from the cabin, feeds it back into the cabin ex 180 degrees out of phase, thr loudspeakers. The idea is that sounds of opposite phase will c out.

7" Television Set

(Continued from Page 79)

ngth to come through the cabi- take a pair of concentric knobs. ou use a commercial tuner, it ive to be mounted primarily to chassis and the cabinet design n detail to bring the knobs just This may mean varying the slope picture face or varying its height w the chassis to slide farther in it.

the RT and H tuner, the spindle made any length you like, with of careful work. In our own e extended the switch shaft by ig to it a length of brass tube.

original shaft was slotted and a was filed at the end of the ex- to form a mechanical joint. This refully lined up with the aid of lamps and a steel straightedge. oldered and dressed smooth.

his technique the inner and outer can be made to any desired length. tandem control also has to be ered, because the shafts are made nge of standard lengths and cannot be trimmed, as can the shaft of an ordinary potentiometer.

If you buy a commercial tuner, the obvious course is to order a tandem control which will match it in terms of shaft length and arrange the cabinetwork to suit.

In our own case, pending a more permanent arrangement, we bought the longest type available, then extended the inner shaft by soldering a short length of brass to the tip of it.

To extend the outer shaft, we simply got a scrap of tubing and filed one end to produce two tongues, which engaged the slots in the existing control. This is not soldered in place but simply floats on the inner shaft, being retained automatically when the knobs are in position.

The knobs, by the way, are standard types bored or bushed or dressed, where necessary, to meet the requirement. We'll have more to say about these when we get around to talking about finishing touches.

usic Hath Power to Soothe..!

(Continued from page 19)

ne form of a swinging pendulum could be altered to swing at diffspeeds. The subject had to follow ndulum with his finger aimed at it music was played.

test displayed that some music it difficult for the subject to fole pendulum because he substituted ythm of the music for that of the dum. If the rhythm of the music ose to that of the pendulum then bject found it easier to follow the dum.

is all proves that the music should ected according to the job, being eat the time. It could quite easily accuracy in, say, jobs where articles to be put in or taken out of a ne at regular intervals, if the music is "out of step" with the rhythm of the operation. Flowing melody without any particular rhythm is the best for this type of work.

Fast music tends to increase the size of a person's handwriting in most cases but in a few cases it is the reverse. Music does not generally increase the speed of handwriting if it increases the size but there is often a considerable increase of speed, if there is not an increase of size

The speed of typewriting is not greatly influenced by music of any kind. On the other hand, any work requiring great thought is usually done better without distraction of any kind. That is why I write this stuff early in the morning when my son has finally switched off the radio and there are no distractions except the budgerigar and he just won't be "turned off". Whether my diligence is reflected in the quality of what I write is a matter for my readers or the Editor. I don't get many brickbats—or bouquets, either, for that matter—so I suppose I am somewhat appreciated.

SPECIMENS for electronic microscopes have to be extremely thin, otherwise the electron beam cannot penetrate them. An instrument, called the Electron Mirror Microscope, overcomes the problem by reflecting the electrons from the specimen surface rather than forcing them through it.

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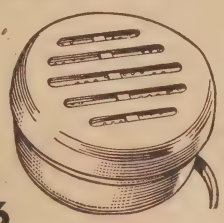

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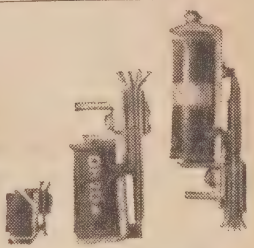

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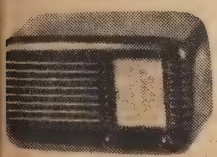

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A.C. Amp. Meters (ex-County Council). A necessity in any electricity workshop.

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Containing metal rectifier, 50V, 100mA, sensitive relay, bezel light, phone jacks, etc.

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Fully Lamin ed Field Wound Ar ture. Six Segment Co mutator, b bearing. Id for Model Trains. Hobbyists, Condition New.

Price, each **32/**

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24 to 32 Volt D.C., Input, Output, 240 50 Cycles at 150 Watts. Suitable for Recorders, Radiograms, Amplifiers, etc

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Five pole push-button switches . . . . . New control box fitted with above switch also 5 bezels with globes and multi contact key switch.

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These English B.S.R. Motors as used on mo tape decks, also have many other uses. Si of motor 3in x 2⅝in x 2¼in with 3/16 shaft, for 240 or 110 volt AC operatio NEW 39
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New H.M.V. spring grammo motors le turntable. Adaptable for many uses . . 19
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Small Plate 0-70 PF, Single Hol
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NSWERS TO CORRESPONDENTS

...gee, Sydney) forwards a query concorrect gauge of wire to use for wirve receiver, and the type of flux to ...e. The query is addressed to "Here's ... Tom".

...ll that you query is unsuitable for ... Tom feature since, on a number ... and quite recently, we have dealt ... identical problems in that feature ... not in possession of back copies we ...briefly the required information. The ...re is not critical for most normal ... may use ordinary hookup wire, ...t covered tinned copper wire, the ...helpful in arranging for neat wiring ...rigidity. Use resin-cored solder and ...components which are trimmed, if ...e necessary to use any additional ... older components or with wire that ...th protective material, like enamel, ...sy to scrape the portion to be soldered. ...non-corrosive paste flux will ensure a ...el joint.

...Aburton, Vic.) submits a number of ...garding TV aerials, ...ain aerials would probably have a ...or of performance to the simpler ...ials. Both must be regarded as a ...ubstitute for a proper outdoor aerial. ...ery favorable locations. The main ... ghosts rather than signal pickup ...kely to be achieved with these aerials ...ffected by so many factors that it ...impossible to forecast performance ...tical test will give the final answer ...at the life of a loft aerial would ...indefinite, while an outdoor aerial ...od for many years. Much depends ...uity in the first place of the manu... would be better to advise you on ...ot water service is not likely to ... interference to a TV set, except at ...of switching on or off. In the con... ...f-peak system this would only occur ...twenty four hours. If it proved ...ry it would be a simple matter to ...t contacts with a small capacitor and ...istor, but we doubt whether it would ...

In the case of a loft aerial the ...nal in the roof may give rise to ghosts, ...n aerial installation will minimise this ...he type of lead used for an indoor ...s probably not critical, though 300 ...ms, as used for most current installations, ...pear to be the logical choice.

...ndagai, NSW) writes to enquire ... know of any organisation who can ...t headphone magnets, or how to ...e his job himself. He also wants to ...whether there are any problems associated ...se of a genemotor in place of the ...vibrator pack for car radios. Fin... some caustic comments to make ...TV ...

...he does not seem to be much future ...go remagnetise these magnets yourself ...h we know of no organisation who ...ch service in the normal way. However, ...est that you contact some of the local ...facturers who normally have magnetis... ...lis available and who may be prepared ...rvice this job. There are normally no ...ections to the use of genemotors in ...ibrators, while they have the advan... ...ctually eliminating the hash problem. ...ly here is the question of space, while ...also guard against mechanical noise ...mmes makes it necessary to mount the ...se remote spot.

...anks for your comments regarding TV ...agree that some of the program material ...ch to be desired, most owners so far ...d they are able to find a reasonable ...ber of programs which suit their taste. In ...nt of interference we can only assume ...e demonstrations you witnessed were bad ...ir this is not a serious problem within ...politan area provided the set is cor... ...ested and installed. Our main critic... ...elled against those salesmen who are ...ible or unwilling to adjust their sets ...rly. In many cases they fail to produce ...ure which is a true indication of the ...mage being obtained in normal domestic ...ditions. As a result, many people who ...another standard of comparison are being ...ed impression you received.

...J. (Wauchope, NSW) writes to tell us ...at he enjoys R T and H and describes ...rticles as very informative. He also sends ...teresting case history for the Serviceman. ...May thanks for your comments and kind ...gs. A.R.J., and you may rest assured ...we will do our best to maintain and im... ...ir standard. Many thanks also for the ...ist story which we will pass on to the ...eam.

...M. (Toowoomba, Qld) forwards one ...bscription and expresses his appre... ...of the magazine. I.D.M. wishes to ...00 PP output transformer in the 20-...a-Linear Playmaster, and would like ...to if it is possible to do so, without ...detrimental effects to the performance.

A.: Many thanks for your subscription and the appreciative comments I.D.M. The subscription has been forwarded to the appropriate department. The use of a 4500 PP output transformer in the 20 U-L amplifier, should not affect the performance at ordinary listening levels. However, the maximum power output will be less than that available from the unit if a transformer with the speci... impedance were used. If you have such a transformer on hand, by all means use it. On the other hand, if you have to purchase one, we would recommend a transformer with the higher primary impedance, as specified in the original article.

A.D.H. (Pakenham East, Vic.) wishes to know what a moving coil headphone is, and whether any advantage would be gained in using it with a three-valve set.

A.: A moving coil headphone is similar in operation to a moving coil loudspeaker; in fact it is a miniature replica of a moving coil loudspeaker. The only advantage likely with this type of headphone is an improvement in the quality of reproduction. There is, however, a disadvantage in that moving coil headphones are generally low impedance devices, and may require a matching transformer to present the correct load to the output stage.

No Name (Manly, Qld.) points out an error in the article on acoustics in the December issue. He also puts a query regarding a dis posals voltmeter.

A. You are correct. However, the error is fairly obvious and does not detract from the sense of the article. We assume that your reference to the feet symbols in the formula is connected with the dimensional correctness in terms of mass, length and time. It must be remembered that the constant is not a pure number and in fact its dimensions would be T times L/L making the whole equation physically correct. Without further information we cannot be of much help on the ammeter question. It is possible that the original multiplier resistance has been removed and a shunt substituted making the cardboard scale correct.

D.H. (Armidale, NSW) wants to know if there is locally available an equivalent to the CK722 type transistor. He also suggests that we describe some transistor receivers instead of oscillators, multivibrators, etc., and wants to know if we have ever described a pocket receiver incorporating transistors.

A. Unfortunately D.H., you do not state the purpose for which you require the transistors, which makes it difficult to give you the most useful information. However, we suggest you consider the types TS1, TS2 and TS3 marketed by Standard Telephones and Cables. We would very much like to describe the transistor sets you suggest, but, as we have pointed out in these columns before, there is little point in our doing so until ample supplies of suitable transistors, coils, transformers, etc., are available. As yet only small quantities of these have been imported or manufactured locally. On the other hand, we do not describe many oscillators and it is a good many years since we described a multivibrator. We have never described a pocket radio, though we agree that it would be a natural development around suitable transistors.

L.J. (Arnaud, Vic.) would like some information on an aerial and earth system for a crystal set installed in a bicycle.

A. Crystal sets require a healthy signal to be of any use. L.J. and this necessitates the use of a good aerial, generally about 70ft long and placed as high up above the ground as practicable, and an effective earth. As it is impossible to duplicate the above conditions on a bicycle, we are afraid that your chance of receiving any signals are poor, unless you are in the immediate vicinity of a transmitter.

W.H.W.S. (Lismore, NSW) submits a circuit and description of a 20,000 o/p/v multimeter using a 50 uA meter movement, and points out that it may be of interest to other readers.

A. Thanks for the contribution, W.H.W.S., we shall file the circuit and the information for possible future use on the Reader Built It page.

C.S. (Caulfield, Vic.) submits a circuit taken from an overseas journal and which is referred to as an automatic attenuator. Its purpose is to reduce the output of a signal generator as the gain of the set is increased due to alignment adjustments. He suggests it may be of interest to other readers.

A. Many thanks for the idea, C.S., and we can imagine that it could be quite useful in certain applications. It appears to function by rectifying the audio output from the receiver, applying this as a bias to the grid of the 6B8, and thus controlling its gain. RF from the signal generator is passed through the 6B8, which thus serves as an attenuator. The device would have no means of knowing that the set was exactly in tune, but merely that there had been a change in sensitivity. We imagine that it would be most useful in factory production lines, where large numbers of sets having similar characteristics are handled. Its value in a service shop would be less obvious. We imagine that there would be a lot more for its successful operation than is implied in the circuit. Naturally it would have to be built as part of the signal generator or be very carefully shielded in a separate box if leakage was not to ruin its performance. Also it would be most important that RF, which may be present in the receiver output, did not find its way into the device and possibly upset its performance. We will file the idea for possible use in the Reader Built It section.

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Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cut-outs in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

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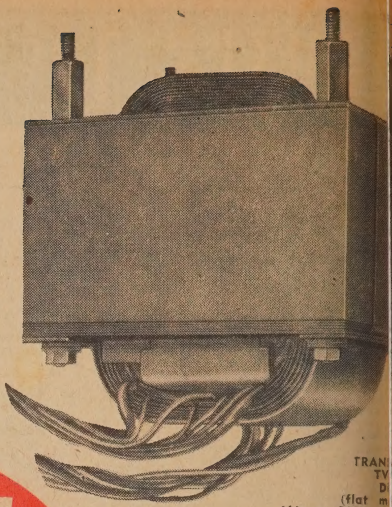

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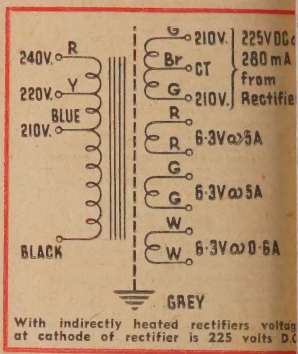
National

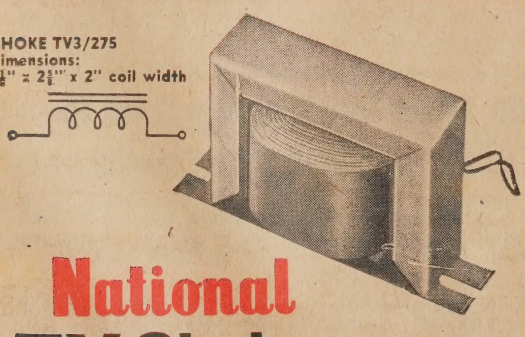
POWER TV TRANSFORMER

The new National TV280/210 TV Power Transformer, illustrated top right, protects your picture tube by a separate winding which supplies the heater voltage to the picture tube only.



With indirectly heated rectifiers voltag
at cathode of rectifier is 225 volts D.C

CHOKE TV3/275
Dimensions:
3⅛" x 2⅝" x 2" coil width



National

TV Choke

- Inductance—3H
- D.C. Resistance—70 ohms.
- Current Rating—275mA
- Fitted with easy-mount clamp.

Retail Price 42/6 (including 25% S-Tax

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Production Facilities

1. NATIONAL is the largest TV tra
former manufacturer in the Commo
wealth with a modern, mass producti
factory capable of supplying the f
requirements of TV. Quality contr
ensure uniformity of production
each particular line. NATIONAL
experience and specialised develo
ment benefit Manufacturers.

TECHNICAL FEATURES

2. Transformer has separate 6.3 volt
0.6 amp. winding to eliminate the po
sibility of a heater to cathode sh
occurring.

3. Unique spacer mounting is provid
to allow the unit to be suspend
under the chassis.

4. Designed to operate at low fl
density and combined with a silic
strap surrounding the laminations r
sults in a minimum external field.

5. Electrostatic shield between prima
and secondary minimise line pick-u

6. Fitted with copper strapping to r
duce external field.

7. Unique lead-anchoring inside t
core prevents leads being pulled ou

8. Low temperature rise reduces t
ambient of the TV receiver chass

elong, Vic.) writes to suggest that the TV tuner of February and the January, to produce a unit capable he TV tuner of February and the January, to produce a unit capable the sound portion of all the TV ell as the FM station.

hanks for your suggestion, A.F.G., some ideas like this in mind ment we are concentrating all our roducing a couple of complete TV ven that is finished we may look for the way of a sound tuner. The bout your letter which puzzles us ence to hum level. You infer that utomatic problem in a system like are at a loss to explain why this . It certainly does not tally with perience to date.

Brisbane, Q) writes to express his of the magazine and to describe f receivers he has built, one of on our own circuit for December.

thanks for your comments and des- the sets F. McM., and they certainly mbitious projects. We are glad to hey perform so well. The distor- long locals sounds like overloading the stages, but it would be difficult the trouble positively without an of the chassis. We doubt whether rial is to blame, since it should be couple this to a regular aerial with- erf overload. We suggest you check d bias circuit carefully.

Hobart, Tas.) says that he has built for 1955". It works but not as similar set built by a friend. Why

be impossible to answer that ques- ly degree of certainty but we gather metter that the regeneration is not as ou could try reversing the connec- reaction coil in case there is an The connections appear to be okay. dry a few extra turns on the wind- ng a reaction capacitor of slightly ue. Reducing the aerial coupling as too large an aerial, too tightly the grid winding can limit the effec- the reaction circuit. An effect equiva- ducing the aerial coupling can be connecting a small capacitor, say n series with the aerial lead in.

L. Col. Light Gardens, S.A.) tells us eing experiences with smaller transistor Apparently he is getting sufficent n a single OC71 to operate a loud- s factorily.

encouraging to know that you have based with the transistor sets. You already noted the recent article and efore too long to have more to say ransistors. By the way, we feel that e voltage you are using with the the particular conditions is a little h side. Unless you do not mind d transistor, we suggest you limit the to 4.5 volts.

Jans Souci, N.S.W.) has a receiver t-set tuning control, but which only n 2NE. He has also experimented mantel set feeding into a set of erminals for additional audio gain, and toknow if this will harm either set. one tuned on this set-up produces k considerable distance, and W.H. is overcome this problem.

Unfortunately, you do not say whether ub with the set occurs only on the ning control or whether it is also the manual control. Assuming it is he pre-set control we would suggest ome of the trimmer groups is out of er and it would be necessary to align rch for the station indicated. Your o couple the two sets together are se on the best principles and there a serious risk of the HT voltage mantel set reaching the grid of the ed in the second set. This could be coupling to the HT side of the ough a capacitor of about .05 mfd. er we suggest that the whole scheme tin ideal and that a proper amplifier necessary gain would be a far better th. The feedback in the microphone l be governed mainly by the gain is no way of eliminating this trouble. lection of microphones and speakers hav- e noothest possible response will mini- the trouble, but it must be appreciated the effect is fundamental to any micro- loudspeaker set-up and there is no clever y which will eliminate it. The only s separate the microphone and speaker greater distance or to use them in dif- rooms.

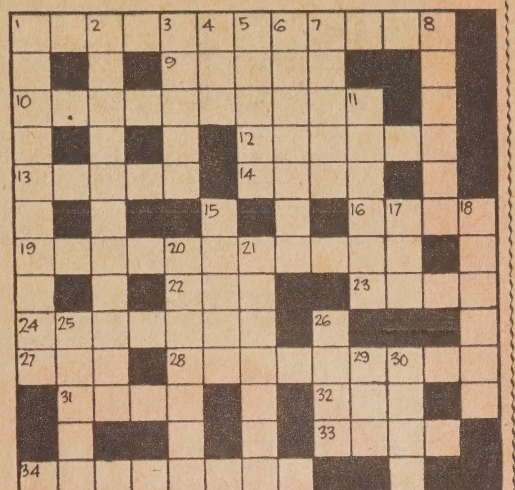
Jackay, Q) writes to comment on one Serviceman articles.

Thanks for your letter which will be d to the Serviceman. No doubt he ment on it in one of his articles.

Mac (Tasmania) asks us to send him the of a one transistor receiver. He encloses

We would be very happy to send you a if you have fallen into the old trap of spending your name to the letter. If not again, we will be happy to forward whatever circuit you require or to refund mon. In the meantime, you may already see the one transistor receiver in the ine.

THE R., TV., & H. CROSSWORD No. 36



ACROSS

1. Electrical measuring instrument.
9. Vision during sleep.
10. Present in a capacitor.
12. Performers in a play.
13. City in England.
14. Opposite to gain.
16. Charged atoms.
19. Compact communication equipment.
22. Wooden lever to propel a boat.
23. The back part.
24. Christian name of one of the Wright brothers.
27. Indicating maiden name (Fr.).
28. Government by the people.
31. An island.
32. To help.
33. Point in circuit where current is maximum and voltage a minimum.
34. To be helped.

DOWN

1. Variation of frequency, phase or magnitude.
2. Two or more valves in one envelope (2 words).
3. Notions in the mind.
4. Part of a circle.
5. Substance which readily forms positive ions.
6. Famous radio inventor.
7. Gives out, puts forth.
8. Faculty of thinking.
11. Being more snug.
15. Series of musical notes.
17. Mineral from which metal is extracted.
18. Incidental circuit effects.
20. To join metals with alloys.
21. A recluse or hermit.
25. Narrow straps attached to a horse's bit.
26. Action of a beam of light in TV. (pl.).
29. Spanish for river.
30. Supplements.

Solution and further crossword next month

P.L.J. (Prospect, S.A.) points out that there was a mistake in the circuit for the vertical amplifier of the new wide band CRO which appeared in the February issue.

A. Yes, that is correct. A corrected diagram was prepared and was published in the April issue. No doubt you will already have read the article. No bypass is included at the screens of the output valves because the circuit is balanced and the AC component at this point cancels out. Glad to note that you appreciated the articles and many thanks for your interest.

F.G.P. (Canley Vale, N.S.W.) would like details of a receiver capable of receiving both Australian and overseas amateur stations.

A. A number of receivers which answer this general description have appeared in Radio, Television and Hobbies and if you would care to give us some further information we would be glad to send you a circuit. For example would you like the receiver to operate from batteries or from the power mains and approximately how large (number of valves, say) would you like it to have? You will find details of the usual conditions of the query service on this page.

L.M. (Coogee, N.S.W.) asks some general questions about small receivers.

A. It would be hard to give a satisfactory answer to your question on this page and therefore it may be best if we hold your letter with the idea of including it in the "Here's Your Answer, Tom" feature.

Last Month's Solution

I	C	O	N	O	S	C	O	P	E		L			
N		N		V	I	A		L		L	E			
F	L	O	W	E	R	S		A	P	I	A			
R	E	F	E	R		T	E	T	R	A	D			
A	I	F		H			V	E	E	R	S			
R		S	H	E	L	L	A	C						
E		W		A		E		I	R	O	N			
D	R	I	F	T		C	A	R			E			
		T	E	E		H		C	L	I	P			
L	A	C	E	D		E		U			E			
	T	H			T	R	A	I	N	E	R			
	O	E		O		I	T	S			S			
	M	O	N	I	T	O	R		W					

A SIMPLE RECEIVER FOR THREE BANDS

(Continued from page 55.)

With the coils in place, you will be itching to switch the set on for the first time.

Plug in the 6U8 only for a start and switch on the mains power. The cathode should light to a dull red color and there should be no sign of heating elsewhere in the set. If all is in order, switch off, plug in the 6X4 rectifier valve and switch on again. The cathode should light to a dull red color but again there should be no sign of sparking inside the valve nor should the plates show any sign of color.

While making this test it is a good idea to have one hand on the power switch so that you can remove the power at the first sign of distress.

If all is in order you should be able to connect aerial and earth and speaker or phones and start tuning in stations. If the set does not show signs of life, it is most likely that there is an error somewhere in the wiring and the best plan is to check again with the circuit.

For those who have instruments or can borrow them, the high tension voltage, measured at the junction between the 6800 ohm resistor and the speaker transformer should be about 150 volts. The total high tension current should be between 6mA and 7mA.

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FOR SALE: Sound mirror tape-recorder, case slightly marked, in good working order. £65. Another complete with mic. 20ft mic. lead unused LP tape (7in). £75.
Wanted: A good test meter, reasonable. **Phone LU3545 (Sydney).**

FOR SALE: Compound Marine Engine and Boiler for sale. Link motion. Feed pump. Boiler Little used. £75. **Bolton, 72 King St., Sydney.** Catalogue 5/-.

FOR SALE: Complete Studio Equipment for tape or transcription disc recording, including microgroove. Genuine professional standards. Best offer. Demonstrations any time. **Phone C1854, XA2363 (Melb.),**

FOR SALE: Back nos. R. and H. 2/- posted. Every copy available in plentiful supply from April, 1939, to the last copy printed. Don't be disappointed. Be sure to get your copy from **A. J. Cox, 13 Glover St., Belmont, N.S.W.**

FOR SALE: Hi-Fi Leak Amplifier, complete TL10 outfit, near new and with set spare tubes, guaranteed any test or trial for genuine buyer, best offer. **JX1286 (Syd.).**

FOR SALE: New type "S" ac power supp., £20. **K. J. McGregor, Kendal St., Cowra, Ph. 635.**

SELL: Communications Receiver BC342H. Good order, £30 or best offer. **J. Langley, 35 Canonbury Grove, Bexley North, Sydney.**

SELL: AR8 modified to 6V6 output; good order, £18½ **WF8055. 274 Great North Road, Abbotsford, N.S.W.**

SELL: Small Rack, PSU, etc., £4; 807, 15/-; AT 300 Tx, £1; SCR522, £2; F Phone, £3; W Guides, £1; New Rola Spkr., £1. **Butler, 1 Darley Road, Randwick.**

SELL: IT4's, 354 other small parts. **Wanted,** 60ma 225V trans. or similar. **WM4096, Syd.**

SELL: Three genuine American "PRETO I.C." high fidelity disc-recording cutterheads 500, 15, and 8 ohms matching impedance. Freq response 25 c/s—17 Kc/s. All three cut microgroove or standard discs and fit Royce traversing equip. £25, £26, £26 respectively. **I. Watson, 2 Redcourt Ave., Armadale, Vic. UY5379.**

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SELL: All back issues of R. and H. 2/- per copy incl. post. **T. Weir, 56 O'Connor St., Haberfield, NSW. UA2569.** Will buy copies, spares, broken set, etc.

WANT: Radio Service Manuals, Volumes 7, 9, 10, 11. **N. Wong, 127 Wharf St., Brisbane, Qld.**

WANTED: University valve and circuit tester, T.S.T. or Palec, in good order. Conditions and price to **A. L. Trapp, Kendall's Radio, Parkes.**

WANTED: M70G sighting telescope. **F. Isaac, 15 Hexham Av., Myrtle Bank, S.A.**

WANTED: Multi meter kit, preferably partly built, R.T. and H. junior or MK1. Price, particulars, **R. Patterson, Box 5, Watson, S.A.**

WANTED: Manual for 108 Mark III, 2.5 to 3.5 meg. c. walkie talkie set. **R. Campbell, Box 42, Sorrento, Vic.**

WANTED: Comm. Receiver, such as AR88, HRO or comparable U.S.A. receiver. If desired will trade BC348P as part payment (xtal double conversion, 14 tubes a.c. operated). Price and details to **A. Roudie, Croydon Way, Croydon, Vic.**

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